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BOARD OF NATURAL RESOURCES
COLSTRIP HEARINGS

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FOR

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MONDAY, MARCH 22, 1976

The hearing reconvened at 1:37 P.M. on Monday, March 22, 1976, in the Chambers of the Montana House of Representatives, State Capitol, Helena, Montana.

The Honorable Carl M. Davis, Hearings Examiner, presided over the proceedings.

APPEARANCES:

Applicants:

John L. Peterson, Esq.
John Ross, Esq.

Department of Natural Resources and Conservation:

Arden E. Shenker, Esq.
Donald MacIntyre, Esq.

The following proceedings were had:

HEARINGS EXAMINER: Very well, shall we proceed?

PHILLIP C. TOURANGEAU, called as a witness by the Department of Natural Resources and Conservation, having been first duly sworn upon his oath, both as to his written direct testimony and as to the oral testimony to follow, was examined and testified as follows:

MR. PETERSON: Mr. Davis, for the record, the applicants will object to the --

MR. SHENKER: Let me offer them first, Jack.

MR. PETERSON: All right.

MR. SHENKER: On behalf of the Department of Natural Resources and Conservation, we offer the statement of testimony of Phillip C. Tourangeau, and the exhibits that are identified in that testimony and are marked as DNRC Exhibits number 241, 242, 243, and 244. I believe that Mr. Tourangeau's statement has been corrected and the corrections have been furnished to the court reporter. I better make the corrections for the record to make sure that we have them all. On page 12 of the statement, line 8, Table 1 should read Exhibit 241; line 10, Figure 1 should be Exhibit 242; line 13, Figure 2 should be Exhibit 243; line 14, Figure 3 should be Exhibit 244; page 13, line 28, the word "is" should be "are," and between the words "their" and "function" should be inserted the phrase "structure and;" page 14, line 2, instead of the phrase "not cause the least," the phrase should be inserted, "result in greater than minimum;" page 14, line 3, "the" should be "their;" page 15, line 10, the name "Moye" should be "Noye. Those corrections have been previously furnished to the applicants.

HEARINGS EXAMINER: Very well. Mr. Peterson?

MR. PETERSON: Mr. Davis, for the record, the applicants object to the introduction of the statement of Phillip C. Tourangeau upon the grounds that the statement was served on the applicants on March the 2nd, 1976, and the amended statements with corrections on the exhibits served on or about March the 13th, 1976, and due to the fact that this is long after the time set in the order of the Hearings Examiner for the presentment of statements of witnesses on behalf of the parties to this proceeding. It does not constitute -- it constitutes a violation of that order and should not be received.

HEARINGS EXAMINER: Very well. Objection is overruled.

(THE WRITTEN DIRECT TESTIMONY OF PHILLIP C. TOURANGEAU WAS DIRECTED TO BE INSERTED AT THIS POINT.)

STATEMENT OF PHILLIP C. TOURANGEAU

My name is Phillip C. Tourangeau and I live at 1705 Defoe Street in Missoula. I am employed at the University of Montana Environmental Studies Laboratory. I am responsible for the functioning of that facility. I received a Bachelor of Arts Degree in Biology from the University of Montana in 1971.

I attended the University of Utah from 1966-68 when I received a teaching assistantship in Limnology at the University of Montana Biological Station at Yellow Bay. I remained at Yellow Bay as a research associate participating in studies designed to determine the effects of various water pollutants on species of aquatic invertebrates indigenous to Western Montana. While at Yellow Bay, I also participated in a study designed to assess the role of DDT and DDE in the declining reproductive biology of the Flathead Lake osprey population, and conducted a study to determine the partitioning of DDT and DDE in the various components of the Flathead Lake ecosystem.

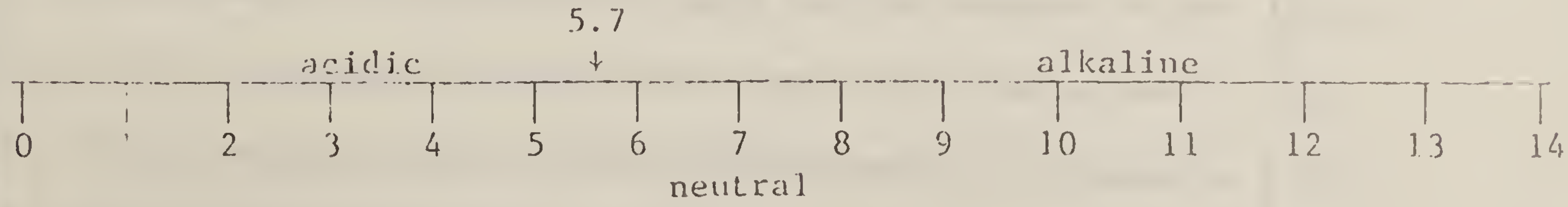
I came to the Missoula campus in October, 1969. Since that time I have been continuously employed in the study of the effects of air pollutants upon plants and animals. I have participated in studies at Columbia Falls and Glacier National Park, East Helena, Anaconda, Garrison, Hall, and Billings, Montana; Oakland, Maryland and Mount Storm, West Virginia; Ferndale, Washington and The Dalles, Oregon; Sitka, Alaska; and Hamburg, West Germany. I have been intimately involved in pre-operational studies at Colstrip, Montana, since 1972. These studies are designed to determine the background concentrations of deleterious trace elements, sulfur and fluoride in plants, soils, precipitation, and trace elements and fluoride in indigenous animals, and to determine the effects of the emissions of the Colstrip steam plants upon plants, animals, and the quality of precipitation. Past studies at Colstrip have been funded by the Montana State Department of Health and Environmental Sciences, the Department of Natural Resources and Conservation, and the Montana State Department of Fish and Game. Present studies at Colstrip in the Custer National Forest and on the Northern Cheyenne Indian Reservation are funded by the Environmental Protection Agency, the Energy Research and Development Administration, and the U.S. Department of Agriculture (Surface Environment and Mining) under a cooperative agreement between the University of Montana and Region I of the U.S. Forest Service in Missoula.

I have been involved with studies of precipitation quality at Oakland; Mount Storm, West Virginia; Anaconda, East Helena, and Colstrip, Montana; and have participated in laboratory experiments with the effects of simulated acid rain on conifers since 1972.

In the absence of strong acid, the acidity of "normal" rainwater is expected to be due to the presence of carbonic acid, a weak acid, which is formed when carbon dioxide dissolves in water. At equilibrium with CO_2 concentrations normally found in air, rainwater would be expected to show a pH value of about 5.5 to 5.7, where pH is a number which is defined as the negative logarithm of the free hydrogen ion concentration: $[H^+]$ or,

$$pH = -\log_{10} [H^+]$$

On the pH scale shown below:



pH 7 is neutral, and in a solution of pH 7 the free hydrogen ion concentration equals the hydroxide ion concentration. At pH values lower than 7, the hydrogen ion concentration is greater than the hydroxide [OH^-] concentration. The smaller the pH value the greater the hydrogen ion concentration. Increasing the hydrogen ion concentration 10 times decreases the pH only 1 unit. "Normal" rainwater, then, with a pH of 5.5 to 5.7 is slightly acidic.

However, approximately 20 years ago, in both the northeastern United States and in southern Sweden, the acidity of rainwater began to increase. This increased acidity in rain has resulted in the phenomenon which has come to be called "acid rains." Such rains, with pH values below 5.5 are commonly occurring in the northeastern U.S., east of the Mississippi and north of the Mason-Dixon Line. The acidity value has been reported to average about pH 4, but values between 2.1 and 5 have been recorded for individual storms.

The evidence from central New York and New Hampshire indicates that sulfuric, nitric, and to a lesser extent hydrochloric acids are responsible for the increased acidity there. In Sweden the acidity is apparently due primarily to acid sulfates. These acids are secondary pollutants and are generated as a result of the oxidation of sulfur and nitrogen oxides which are injected into the atmosphere from fossil fuel combustion and industrial processing to acid sulfates and nitrates. Hydrochloric acid may result from the reaction of these acids with "sea-salt" (sodium chloride). Acid sulfates and nitrates may be transported for long distances before deposition. The Swedish evidence indicates that most of the anthropogenic sulfur there originated in Great Britain and the heavily industrialized Ruhr Valley. Furthermore, increased acidity in individual storms in the northeastern

U.S. may be traced to air masses passing over the Ohio River area 2 to 3 days previously. The Swedish evidence shows that at least acid sulfates may be transported for distances up to 1000 kilometers, or about 600 miles.

Although the evidence for a lack of strong acids in rainwater in the northeastern U.S. prior to about 1940 to 1950 is indirect, it has not been shown that acid rains commonly occurred there before that period. The increased acidity in precipitation is, however, associated with a change in the spatial distribution of large sources of sulfur oxides and the increased emissions since 1950 of sulfur oxides from electric power generating stations.

The change in the spatial distribution of sulfur oxide emissions occurred as a result of the growth of the electric power industry and the construction of large generating plants in rural areas upwind of and away from dense population centers. Indeed, the growth in the total sulfur oxide emissions since 1960 is almost totally attributable to electric power plants. Because these and other sources inject SO_2 and NO_x into the atmosphere from tall stacks (500' and greater) and retain or do not generate neutralizing particles, the SO_2 and NO_x may be dispersed over wide areas, be oxidized to acid, and be deposited in rain at long distances downwind. Furthermore, since sulfur dioxide is soluble in water, acid rains are possible at very short distances (within 30 miles from these sources). Such events have been observed in the U.S. and in Sweden. Additionally, nitrogen oxides appear to be oxidized to acid much more rapidly than is sulfur dioxide, compounding the potential for local effects.

Detailed and meticulous chemical analyses of rainwater falling in the northeast U.S. have shown that sulfuric, nitric, and hydrochloric acids are responsible, in order of decreasing importance, for the acidity of acid rains. These analyses have also shown the presence of weak organic acids in trace amounts, contributing up to 20% to the total acid in rural areas, and from 20% to 50% of the total acid in semi-urban areas. These weak acids, however, contributed only from 0-10% of the free acidity and occurred in greatest amounts in urban areas.

Two other studies have purported to show that weak acids are responsible for acid rain, and the investigators have suggested that their results cast doubt on the fact that strong acids are responsible for the pH of acid rain. They further submit that their results indicate that the pH of "normal" rain was never governed by carbon dioxide. The first of these two studies (1) led the authors to conclude that the mean pH values of their samples were in agreement with the pH values as reported by others for acid rain; that the acid which they detected was a weak acid; and that it had all of the characteristics of carbonic acid. The mean pH values ranged from 3.90 to 4.30. Individual samples showed values as low as pH 3.22.

The normal concentration of CO_2 in the atmosphere is about 320 ppm, or about .032%. To achieve pH values as low as those reported would require concentrations of between 20% and 100% CO_2 in the ambient air. There is little doubt, however, that the authors measured carbonic acid in their samples, since the collectors were packed with dry ice, which is frozen carbon dioxide. As the dry ice sublimated, the atmosphere in the immediate vicinity of the rainwater collector contained large concentrations of CO_2 which would dissolve into the rainwater. Experiments have been conducted here in Montana employing dry ice as a coolant, which have repeated the results.

In a second study (2), the authors measured rainwater with pH values in agreement with those which have been reported in acid rain in northeast U.S. Because the free acidity was less than 55% of the total acidity in all samples, the authors considered the acid present to be a weak acid. Inspection of their data, however, shows that that conclusion cannot be drawn. In the rainwater samples the free acid fraction decreased as the pH increased. Weak acids behave exactly the opposite: as the pH increases the free acid fraction increases. At pH values of 4.39, 4.39, and 4.41, the data in this second study shows free acidity at 53%, 38% and 31% of the total acidity. If a weak acid were responsible for the acidity, it would have only one value for the free acid fraction at pH 4.39, and although the value at pH 4.41 would be close to the value at pH 4.39, it would be higher--not lower. Most importantly, if a strong acid is added to a solution of weak acid, the system would behave, overall, as do the rainwater samples, which must be considered to be solutions of varying amounts of substances which may be weak acids and strong acids. The samples in this study were collected about 6.7 miles north of downtown Pittsburgh, Pennsylvania, which would be a semi-urban or urban area. As has been mentioned, weak acids, resulting in free acidities of only 50% of the total acid have been detected in other northeastern semi-urban areas. However, because substances other than weak acids can contribute to the apparent acidity of solutions, and because the authors did not make detailed chemical measurements of the contents of the rainwater, their conclusion:

> "The presence of weak acid species in precipitation casts additional doubt on the idea that the pH of rainfall was ever controlled by the solubility of CO_2 in the precipitation

> and discredits the assumption that strong acids account for the presently observed pH value."

is unfounded. Likens, et al. (3) have appropriately commented on this study:

> "The meaning of the total acidity data published by Frohliger and Kane is impossible to assess, given the incomplete information on collection and analytical techniques, and the absence of complementary chemical data. Further, their data base is severely limited in both time and space. Yet, from these data sweeping generalizations are made about the chemical nature of rainfall around the world and in the geologic past. Because of its ambiguous nature, the data of Frohliger and Kane are not illuminating regarding the acid chemistry of precipitation. Certainly, these data do not provide any basis for dismissing the presence of strong mineral acids in precipitation as Frohliger and Kane have done.
>
> The central question in the 'acid rain' problem is not whether weak acids exist in precipitation. Rather the serious issues are: i) Do the strong acids and heavy sulfur and nitrogen loads in some contemporary precipitation come from anthropogenic sources? ii) What trends exist in geographic distribution and intensification of acid precipitation? and iii) What are the environmental stresses elicited by both strong and weak acids in precipitation? Scientists addressing these and like problems are entitled to the usual standards of quality control in data published in their field."

The potential environmental effects of acid rains are known only imperfectly--however, they are complex, they are manifold, they may be difficult to measure given the present state of knowledge. They may be subtle, but the repercussions are serious. They include: decreased soil fertility; decreased forest and grassland productivity; the acidification of lakes and streams; effects upon the metabolism of organisms; effects upon organisms directly; decreased agricultural productivity; and damage to maeterials, including architectural and sculptural works of art.

The potential and measured deleterious effects of acid rain have recently been reviewed (4,5), and the First International Symposium on Acid Precipitation and the Forest Ecosystem (6) which was co-sponsored by the U.S. Forest Service was held in May of 1975 here in the U.S.

Studies on the effects of acid rain on the productivity of coniferous forests have been conducted in Sweden where many soils are naturally acidic and deficient in nutrients. A significant reduction in growth in stands most susceptible to soil acidification by acid deposition occurred between 1945 and 1965. The extent of the reduction has been estimated to be about .3% per year, but it may be as high as 1%. By extrapolating, based upon assumptions of increased SO_2 emissions in Western Europe, the Swedes estimate that by 2000 the reduction in growth of commercial forests might be 15%. In the U.S. and Canada in Maine, Ontario, and Quebec, commercial forestry is based principally on coniferous species. These areas lie downwind of the major SO_2 emitting areas of Ohio, western Pennsylvania, and West Virginia. Since acid rains and high rates of sulfate have been recorded there, similar effects as occurred in Sweden are to be anticipated.

In a deciduous forest in New Hampshire an "abrupt and striking" decrease in volume growth took place about 1960 and amounted to 18%, an unprecedented reduction in the history of that forest. However, the authors could not relate that decrease to acid rains, but leaching of nutrients from the leaves was observed and drought may have been involved.

Perhaps the most obvious deleterious effects of acid rains is the acidification of lakes and streams. In Sweden, where the greatest amount of work has been done, a decreasing trend in pH in lakes and rivers was noted during 1965-1970. In Ontario, Canada, some lakes west of the Sudbury smelters had become critically acid by 1970. Serious mortality of young age-class salmonid fish has been reported in Sweden, and in the Canadian lakes most fish species failed to reproduce when the pH fell into the range 4.7 to 5.2. This has been directly attributal to increased acid deposition by precipitation. Disappearance of the fish followed failure of eggs to hatch. In Massachusetts it has been reported that many lakes and streams show peaks of springtime acidity in the range of pH 4.5 to 5.5. This has resulted in the delaying of trout planting. In the Adirondack Mountains of New York State a "large, clear, oligotrophic" lake has had a reduction in pH from 6.6 to 7.2 in 1938, to 3.9 to 5.8 in 1959-1960.

The study of the direct effects of acid rain on plants, including agricultural crops, is in its infancy. Foliar abnormalities, including reduction in length of the needles of ponderosa, Scotch, and white pines have been observed, and the syndrome has been reproduced by simulated acid rains at the University of Montana Department of Botany and the National Ecological Research Laboratory at Corvallis, Oregon. Foliar abnormalities have also been observed on yellow birch, at pH 3.0.

Seedlings of kidney beans and soybeans are reported to experience acute injury when misted at pH 3.2.

The most serious effect of acid rains upon plants would be the reduction in chlorophyll content, since extracted chlorophyll "bleaches" when the solution is acidified. However, while simulated acid rain reduced chlorophyll in moss, beans receiving treatment with acid mist did not show a loss in chlorophyll. The beans did, however, exhibit a loss in the ability to produce carbohydrate, indicating a much more subtle influence with photosynthesis than chlorophyll bleaching. Because of the reduction in the ability to generate carbohydrate, these plants would consequently be expected to show reduced productivity.

Perhaps the most readily identifiable effect of acid rain on soils is acidification leading to decreased fertility and loss of nutrients. Although soils neutralize acids, the neutralization process removes cations such as magnesium and calcium and permits their leaching. On poorly buffered soils, all of the acid may not be leached and runoff may be acidic.

Plants exhibit different degrees of susceptibility to acid rains, and individual species may differ at various times in their life cycles. No recent studies on even single species of grasses appear to have been conducted. A study early in this century subjected timothy grass to sulfuric acid solutions of pH 2.2 to 3.7 for 3 years. At the end of the study, the plots subjected to the least acid treatment showed decreased productivity, while those receiving the more acidic treatments were dead.

Although studies are in progress which are concerned with the effects of acid rains on forest ecosystems, no information appears to be available concerning acid rain effects on grassland ecosystems, including the mixed prairie grasslands in the Colstrip vicinity.

This is deplorable since Colstrip Units 1 and 2 are predicted to inject 520 grams of SO_2 and between 478 and 508 grams of NO_2 per second into the atmosphere while Units 3 and 4 are predicted to add 1170 grams of SO_2 and between 1069 and 1136 grams of NO_2 per second to those amounts. This amounts to 58,692 tons of sulfur dioxide and between 53,757 and 57,090 tons of NO_2 per year. As has been stated, these gases may be oxidized to the secondary pollutants acid nitrates and sulfates.

There is considerable controversy and disagreement about the rates at which SO_2 and NO_2 are oxidized to acids. Values from .1% to 1% per hour have been reported for SO_2 in clean air, and estimates of as high as 30% per hour for SO_2 in power plant plumes in polluted air have been suggested. It is thought that the oxidation rate of NO_2 is 3 to 4 times as fast, at the least. If a rate of .5% per hour oxidation for SO_2 to sulfate is assumed, as has been done to predict increased sulfate levels to the human population at risk 300 miles downwind from a 600 MW power plant, and a rate of oxidation of NO_2 to nitric acid with a half life of 2 to 3 hours as has been measured in power plant plumes is further assumed, it is possible to begin preliminary estimates of the effects of the Colstrip units on precipitation.

The following conditions are assumed: the wind speed u = 5 meters per second (18 km/hr or 11 mph), the width of the plume at a given distance from Colstrip is governed by the horizontal standard deviation, the wind speed is constant at all times = T, and all pollutants injected into the atmosphere each hour are contained within the volume element of length = 18 kilometers, except those lost by dry deposition. The area under the volume element is always changing and is defined by $A = u^2 \tan \theta/2 (t^2 - t_1{}^2)$, where the angle 9 is determined by the horizontal standard deviation σy

For the purposes of this analysis, only the acids oxidized from SO_2 and NO_2 are assumed to be scavenged by precipitation, although SO_2 has been shown to be washed out of power plant plumes and is known to be oxidized to sulfuric acid in solutions. Ex. 241 ~~Table X~~ shows the pH if the acids are assumed to be uniformly distributed in the volume increment for Units 1 and 2 and for Units 1 through 4. Ex 242 ~~Figure 1~~ shows the pH isopols for .2" rain if the pollutants are distributed in a Gaussian manner in the plume as a function of distance from Colstrip. Ex 243 ~~Figure 2~~ shows the pH isopols for the same conditions for Units 1 through 4. Ex. 244 Figure 3 shows the pH for 1 & 2 and for 1-4 if the pollutants are assumed uniformly distributed.

It must be reiterated that the rates of oxidation of nitrogen and sulfur oxides are in doubt and depend on many factors. The rate as employed here for SO_2 is quite probably low; it is a rate which is assumed for "clean" air while the atmosphere inside the plume will not be "clean." The results of this analysis, furthermore, underestimate the effects of the Colstrip units on precipitation at areas close to Colstrip for two reasons: 1) rainwater falling through power plant plumes absorbs SO_2 where it is oxidized, presenting the opportunity for lower pH values under the more concentrated fraction of the plume. This is not permitted to occur in this analysis at any time; 2) SO_2 is thought to be oxidized at a faster rate close to the source, because compounds which catalyze the oxidation are more concentrated. The rate of oxidation of SO_2 is not allowed to change in this analysis.

The pH values tabulated herein are the result of permitting only that amount of acid contained within a volume increment to be dissolved in the rainwater, and no more acid is permitted to enter the volume increment during precipitation. In reality, there is a continual flux of pollutants across the distal and proximal boundaries of a volume element. Similarly, an amount of precipitation does not suddenly occur; rather precipitation occurs at some rate, for a certain time, and precipitation occurring at some distance downwind will be supplied with a continual flux of acid nitrates and sulfates. Therefore, this analysis undoubtedly underestimates the pH values which may occur in precipitation as the result of the Colstrip units.

This analysis does show, however, that there exists a potential for acid rains from Units 1 and 2 and that the potential will be increased by 3 times with Units 3 and 4. Coniferous species have been shown to be susceptible to foliar abnormalities by acid rains; such species are the timber resource of the Northern Cheyenne Indian Reservation and the Custer National Forest. The grassland ecosystem near Colstrip is also undoubtedly susceptible since the time of most rapid growth occurs during the spring when 50% of the annual rainfall occurs. As has been stated, there appears to be no information available concerning the effects of acid rains on these naturally occurring mixed prairie grassland ecosystems.

In a broad sense, human health and welfare depend ultimately upon the maintenance of natural ecosystems. Agriculture and the timber industry in the Colstrip area are directly dependent on them. In general, the effects of chemical and physical stresses on ecosystems ~~is~~ are to impair their structure and function. Such effects may be very slow, but once set in motion, may be impossible to reverse.

Colstrip Units 3 and 4 will ~~not cause the least~~ result in greater than minimum environmental impact because of ~~the~~ their potential to cause rainwater pH values to be lowered to: 1) those which have been shown to cause abnormalities to conifers, (2) those values which may cause leaching of soil nutrients, and 3) those values which may cause injury to the surrounding grassland ecosystems.

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1. Frohliger, John O., Stanley J. Penkala, and Nancy Katsko. A Report on the Collection and Analysis of Rainfall in Maryland and West Virginia. Prepared for DeNardo and McFarland Weather Services, Inc. September, 1973, University of Pittsburgh, 15261.

2. Frohliger, John O., and Robert Kane. Science, 189, (455) 1975.

3. Likens, Gene E., Johnson, ~~M~~Noye M., Galloway, James N., and F. Herbert Bormann. Acid Precipitation: Strong and Weak Acids. Science, 1976. In press.

4. Likens, Gene E., and F. Herbert Bormann. Acid Rain: A Serious Regional Environmental Problem. Science, 184(1176), 1974.

5. Air Quality and Stationary Source Control, Part 1, Health and Ecological Effects of Sulfur Dioxide and Sulfates. A Report by the Commission on Natural Resources, The National Academy of Engineering, National Research Council. Prepared for the Committee on Public Works, United States Senate. Washington, D.C. 1975. 94-4.

6. First International Symposium on Acid Precipitation and the Forest Ecosystem. Program and abstracts, May 12-15, 1975. Ohio State University, Columbus, Ohio.

TABLE 1

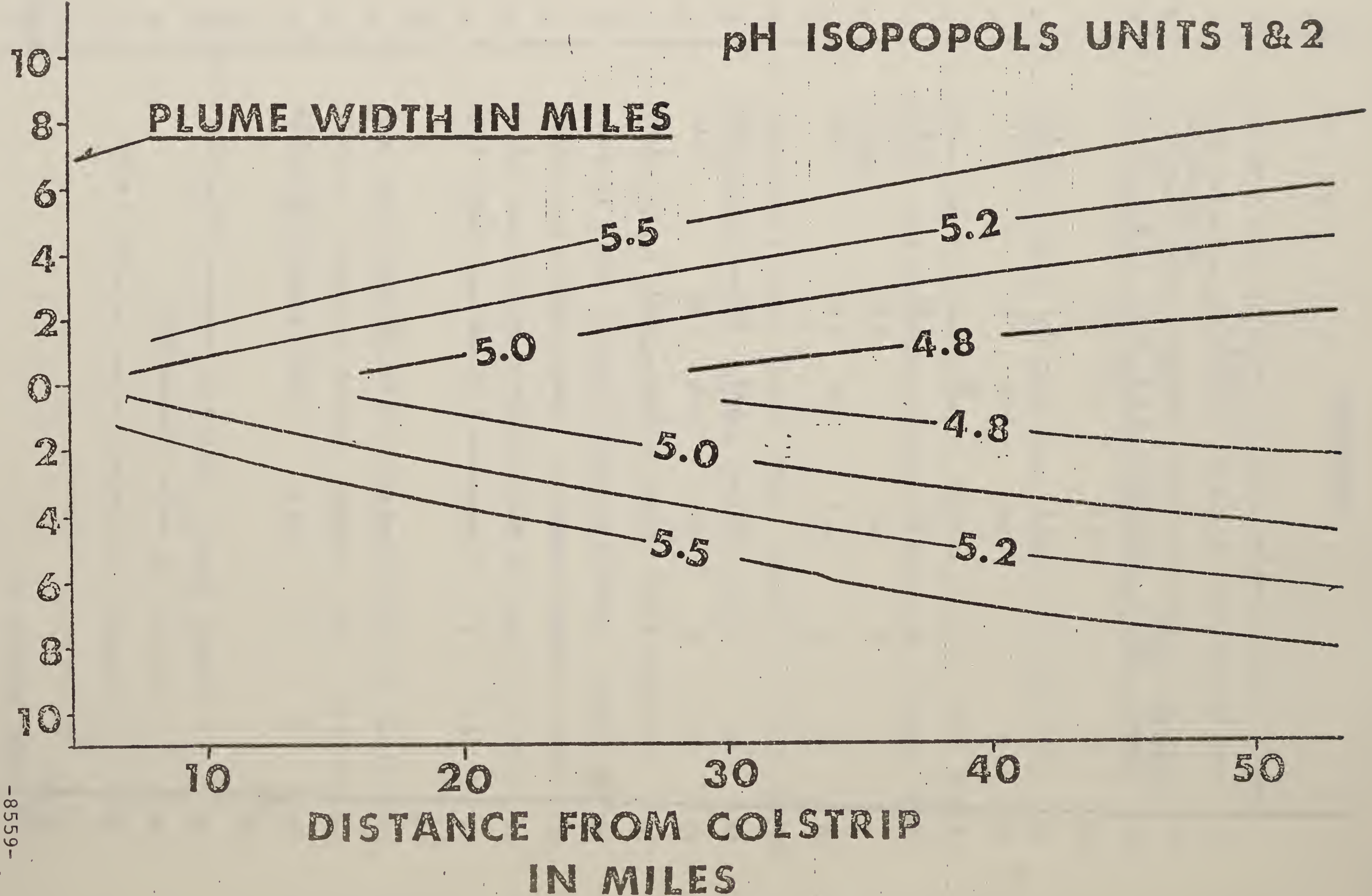
Stability Class*	Time (hrs.)	Distance**	pH for Rain of .2" 1 & 2	.2" 1-4	.4" 1 & 2	.4" 1-4	.8" 1 & 2	.8" 1-4
B	1	5.6	-***	5.27	-	-	-	--
C	1	5.6	-	5.14	-	5.44	-	--
D	1	5.6	5.48	4.97	-	5.27	--	--
B	2	16.7	-	5.09	-	5.39	-	--
C	2	16.7	--	4.95	-	5.25	-	-
D	2	16.7	5.34	4.79	-	5.09	--	5.39
B	3	27.9	5.49	4.97	-	5.27	-	-
C	3	27.9	5.35	4.83	-	5.13	-	5.33
D	3	27.9	5.19	4.67	-	4.97	-	5.27
B	4	39.1	5.42	4.91	-	5.21	-	-
C	4	39.1	5.28	4.77	-	5.07	-	5.37
D	4	39.1	5.12	4.61	5.32	4.91	-	5.21
B	5	50.3	5.39	4.88	-	5.18	-	5.47
C	5	50.3	5.27	4.75	-	5.05	-	5.35
D	5	50.3	5.10	4.58	5.40	4.88	-	5.18

* = Turner, Bruce D. Workbook of Atmospheric Dispersion Estimates. EPA, OAP, No. AP-26. Revised 1970.

** = Distance is to center of volume increment in miles.

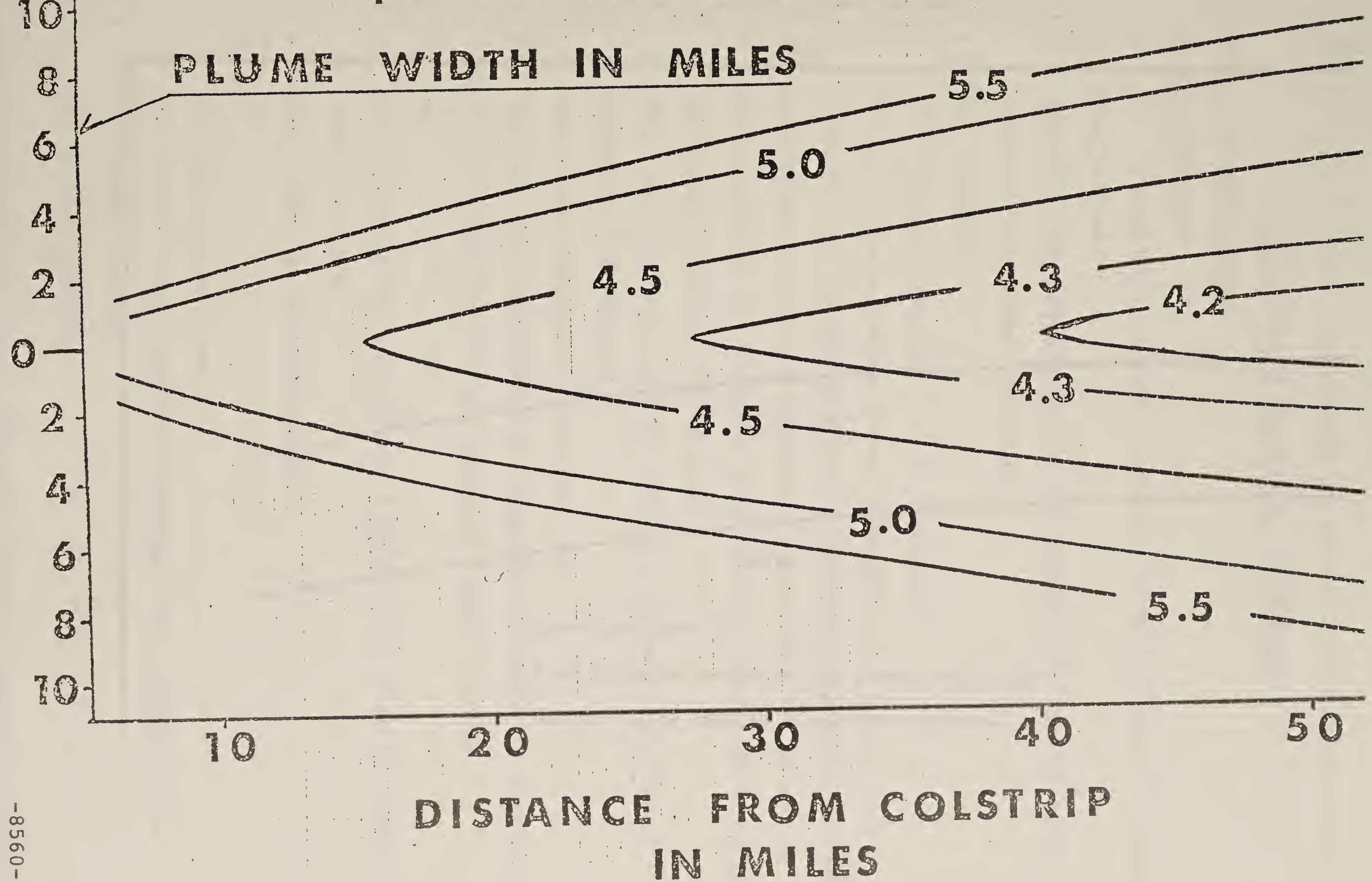
*** = pH not less than 5.7.

DNRC EXHIBIT 241

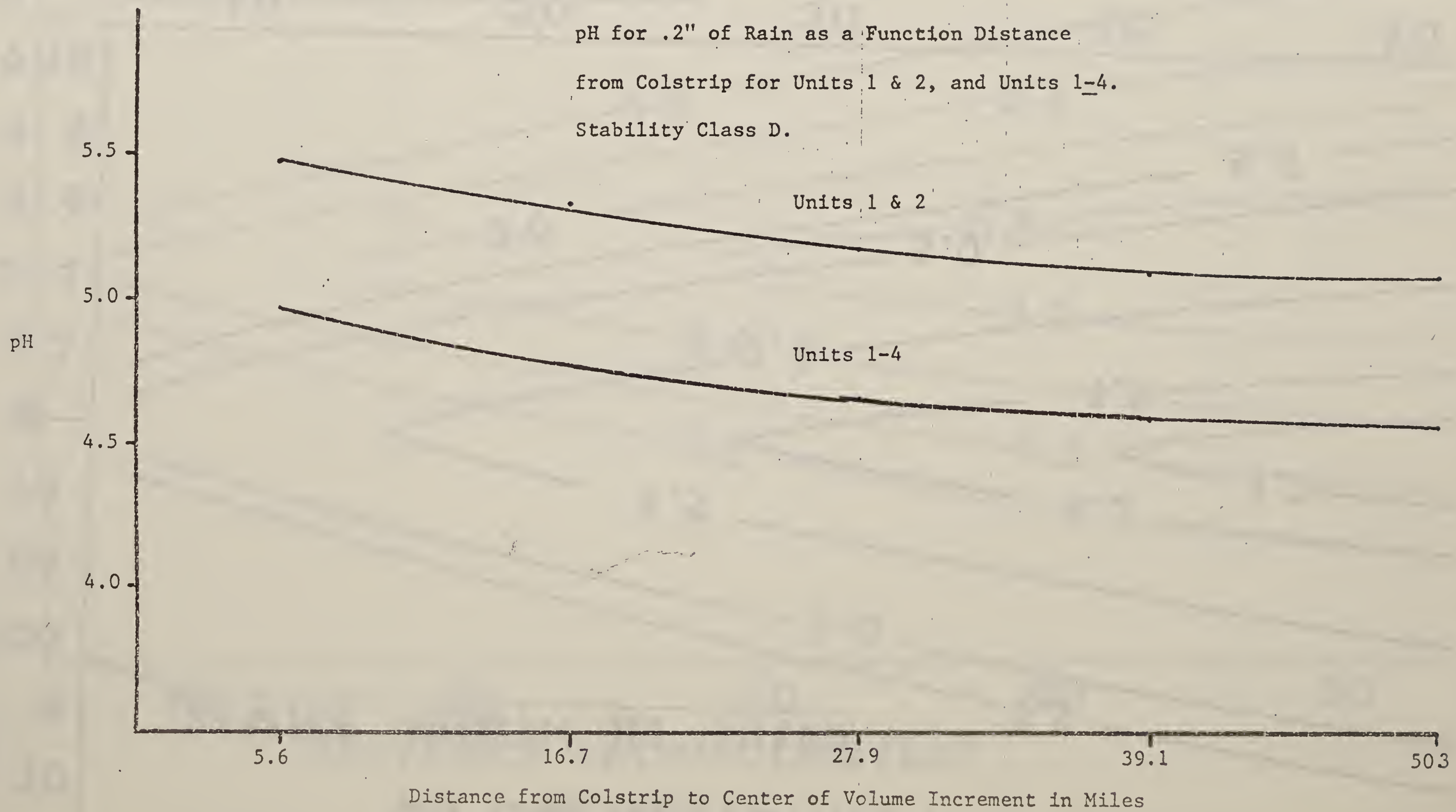

pH ISOPOPOLS UNITS 1&2

DNRC EXHIBIT 242

pH ISOPOLS UNITS 1-4



DNRC EXHIBIT 243



pH for .2" of Rain as a Function Distance from Colstrip for Units 1 & 2, and Units 1-4. Stability Class D.

DNRC EXHIBIT 244

EXAMINATION OF PHILLIP C. TOURANGEAU

Cross, by Applicants,

By Mr. Peterson:

Q Mr. Tourangeau, you have a bachelor of arts degree in biology?

A That's true.

Q Have you had consultation in the preparation of this testimony with any other individual?

A No, I haven't.

Q What training have you had in chemistry?

A About 30 quarter hours formal classwork, and my job as a chemist, too, at the university. I've been employed at the environmental studies laboratory since 1969. It is my job to insure that all chemical activities in there are of proper technique, accurate, and precise.

Q Have you, in your job, ever taken on any work relative to atmospheric chemistry?

A Not actual atmospheric chemistry, no.

Q Have you ever published any documents by reason of your work in your laboratory in any chemical society journal?

A No.

Q Are you presently working for a master's or a Ph.D. degree?

A Ph.D. in botony.

Q And is that at the university?

A Yes.

Q And under whose direction?

A Dr. Preece is the committee chairman. Dr. Preece is the department chairman.

Q Who is your employer?

A The University of Montana.

Q Who is your immediate supervisor?

A Dr. Gorden.

Q Dr. C.C. Gorden?

A Right.

Q How long have you been associated with Dr. Gorden?

A October, 1969.

Q Have you ever testified in any proceeding prior to this hearing?

A Yes, I have.

Q Would you relate those for me, please?

A In about 1970, it was the application from the Anaconda Copper Company to open some activities at Alice Creek, and I testified at that matter.

Q On whose behalf?

A I read a statement prepared for Dr. Gorden. He wasn't able to be there.

Q All right.

A I testified at federal court in Baltimore in the Mount Storm matter, in, I believe, it was April, 1974.

Q On whose behalf?

A On behalf of the christmas tree growers. And that's it.

Q What education have you had in mathematics?

A Through calculus. Two quarters, I believe, of calculus.

Q Two quarters?

A I believe.

Q Have you made any determination as to the present pH in the rainfall in the Colstrip area?

A Yes, we have in the past. These studies, of course, are continuing.

Q What has been that determination?

A Generally, the pH of the rainwater in the Colstrip area has been about 5.5. I do not recall precisely the ranges, or the actual average.

Q You don't recall the ranges?

A No, I don't.

Q Does the range vary with the time of year?

A I don't know. I wouldn't expect that it would, though.

Q Would this average pH in the rainfall be basic?

A Certainly not.

Q Is it normal?

A I'm sorry, I guess I don't understand that.

Q Is the pH in the rainfall at Colstrip normal, in your opinion?

A Yes.

Q If there are ranges above 5.5 on the average, would you consider those ranges to be higher than normal?

A No, not at the present, no.

Q And why not at the present?

A I don't see any kind of an anthropogenic effect on the pH precipitation over there at this time. I think that if pH's of rainwater are shown to be above normal, that is, above the range 5.5 to 6, or something like that, I think that that could be the result, conceivably, of biological activity in the sample, some problem with time from collection to analysis.

Q Would there be any other causes that would raise the pH?

A To make it more basic than 5.5?

Q Yes.

A Not that I could reasonably think of.

Q Would there by any soil or dust contribution?

A There could be if the sample wasn't properly collected; in other words, if dust was allowed to enter into the collector, or if it had been sitting without a lid for some certain period of time, quite a large period of time, probably.

Q I believe you said that you did testify in the Mount Storm area, and I assume, therefore, that you've done some work relative to that area of the country?

A Yes, I have.

Q What was the -- were you able to make any determination as to what the pH was in the rainfall in that area before any power plants went on line?

A No. Not myself.

Q Did anyone, sir?

A I recall a study in the mid-'60's, but I guess it didn't directly apply to immediate vicinity of the Mount Storm area; however, it did make some statements about the general vicinity of the central Atlantic states, and it did make some projections based on what they measured as to the probable cause of the acidity which was present in the rainwater at that time throughout that general area.

Q And this would have been before the power plants went on line?

A I don't know when the Mount Storm station or the other units went on line. But this was an early study, early '60's.

Q What was the pH level at that time? If you can remember.

A Certainly below 5, but above 4. 4.5.

Q What would contribute to that?

A I suppose the same things which are now contributing to the increased acidity in the northeastern United States: sulfuric acid, nitric acid, to a lesser extent hydrochloric acid, air pollutants.

Q And was that the result of the study, or is that what you -- is that your opinion at this time?

A That would be my opinion, but the authors found an increased sulfur loading, and hydrogen ion concentration in precipitation further away from the seacoast, which they made their precipitation measurements, and they conjectured at that time that sulfur dioxide and sulfuric acid could be the only cause.

Q Who were those individuals?

A Can I write it down and let you know later?

Q Sure. Do you feel that the rainfall pH in the Colstrip area could be attributed in a large part to the pH of the soils?

A No.

Q Why not?

A Well, first the rain water rises, what, 6,000 feet? Raindrops are formed, certainly, at least that high. And as you collect rainwater before it gets to the ground, there's no way for soil or carbonates to interact with rainwater, so the pH of the rainwater certainly is not influenced by the soils in the Colstrip area.

Q Turn just to page 5, and go to lines 2 to 7. What is the source of the data which you relate on lines 2 to 7 on that page?

A It is a paper by Bormann and Likens which is in press in Science. And we have a draft, the final draft.

Q Has it been published yet?

A It has not. At least as of last week..

Q Why is it that you consider the amounts of weak acids that would contribute up to 50% of the total acid of the rain to be trace amounts?

A Well, they certainly are present in trace amounts. They're not weak organic acids. Depending on the KA, it takes quite a bit of them to make the pH -- well, pH values, as measured here, would average about 4. It would take a considerable amount of these acids to generate a pH of that contribution, or to contribute that much free acidity to generate that pH. And I think that 20%, in view of the relative contribution of the weak acids to the strong, organic acids, I think that they'd be present in trace amounts. Now we're talking about 20% of the total acid, and when you discuss total acid, you must differentiate that from the fraction of the acid which is present in the dissociated form. Apparently, although it is not detailed in Bormann and Likens' paper, that these would only be measured by titration of the total acid present, so that they would certainly not contribute anything to free acidity, and they're just present in trace amounts.

Q Do you include carbonic acid in this trace?

A No, they've eliminated carbonic acid. They've performed these measurements under nitrogen atmosphere,and they have purged the CO_2 by bubbling nitrogen through the solution.

Q Has anyone else performed any of that type of work, besides

Likens and Bormann? On whom you rely?

A I'm thinking, just a second. I don't know precisely. It is a recommended technique, certainly.

Q With regard to the discussion that you have as to one of the two studies, and that done by Frohliger and Kane, I believe, what has been you last contact with the professor Frohliger relative to his studies.

A About the middle of January, I think. I asked Dr. Gorden to call up Frohliger.

Q How do you pronounce that?

A Frohliger. And asked Clancy to inquire from him whether or not he had employed the precipitation collector of the design which he did in his 1973 studies, in other words, charged with CO_2, and his answer was no, he didn't want to get caught in that trap again. That's my only contact.

Q Do you know whether or not Frohliger has repeated any of the work at Mount Storm without the use of dry ice and obtained the same results?

A Not to my knowledge.

Q Not to your knowledge. Was anyone from the environmental laboratories, or yourself, in attendance at the American Chemical Society conference at the north Atlantic region on February 25, 1976, at Philadelphia?

A No.

Q Do you know whether or not Dr. Frohliger has sponsered that, or has done any further studies, relative to the pH in this area under sponsorship of the University of Pittsburgh?

A No, I don't.

Q Mr. Tourangeau, on page 8, relative to lines 17 to 19, the extent of reduction has been estimated to be about .3% per year, but it may be as high as 1%?

A Yes.

Q What is the source of that information?

A The source of that information is Bormann and Likens' review, 1974, in Science.

Q Is that a published document?

A Yes, it is.

Q Is it referred to in your bibliography?

A Yes, it is.

Q Number 4?

A Right.

Q Are the conditions cited there representative of Colstrip area in your opinion?

A No.

Q Regarding the decrease in volume growth which took place about 1960 and amounted to 18% in the New Hampshire setting, you're not stating there that this reduction in forest growth was the result of acid rain, are you?

A Let me possibly reiterate what the authors concluded. They were not able to directly attribute it to acid rains. And they were not able to attribute that reduction in growth to decreased soil pH. However, they have measured, and they do measure routinely, increased leaching of nutrients from the foliage of these plants when it rains, from approximately pH 4 to pH 4.5. They note that, indeed, most of the rainwater is neutralized during that process. Now, they were not able, and I think I state in my statement that they were not able to directly attribute that to acid rains yet.

Q And that is the same -- are those the same two authors, Likens and Bormann?

A No.

Q Who are you quoting?

A Bormann and Likens are co-authors in this study. There are five or six authors. Let me just make a note to get that to you. I may even be able to do that today. They may be referenced in another paper.

Q Would that be Noye and Galloway and Bormann? Likens?

A I can't find it here. I guess I don't see it in here. Who did you mention to me?

Q Well, I wanted to know if it was the same authors that you report in your bibliography under number 3.

A No.

Q It is not?

A No, it is not.

Q Have you made a study of the interior Canada area wherein you state that some of the lakes west of the Sudbury smelter have become critically acid?

A No, I haven't myself. That's reported in papers.

Q Have you ever been in the area?

A No, I have not been to Sudbury, no.

Q Do you know whether or not there's any clearcut logging in the area?

A No, I don't.

Q If there were, Mr. Tourangeau, could the cause of the low pH in those Canadian lakes be due to water washing off some of the low pH soils following recent logging activity?

A I can't quite conceive that.

Q You cannot concede that, or conceive it?

A Conceive it.

Q When does this situation in the Canadian lakes take place? Is there a particular time of year when the pH factor varies?

A I'm not aware that there's a particular time of year that the pH value varies. I think that this is a slow, insidious thing as the author seemed to indicate over a certain period of time. The lakes have become now just so critical that fish no longer spawn.

Q What author is that?

A Can I look in my book again?

Q Surely.

A Beamish, R.J., 1974,"Loss of Fish Populations from Unexploited Remote Lakes in Ontario, Canada, as a Consequence of Atmospheric Fallout of Acid," Water Research, Volume 8, pages 85-95.

Q Who is Mr. Beavis, or Dr. Beavis, or whoever?

A Beamish. B-e-a-m-i-s-h. I don't know. Now there's one reference that I'm a little bit familiar with that I see.

Q What's the date of that reference?

A 1974.

Q '74?

A Yes.

Q Page 10, beginning at line 13, continuing to the end of line 18, you conclude that paragraph by saying that, on poorly buffered soils, all of the acid may not be leached and runoff may be acidic.

A That's true.

Q Are there any soils in the Colstrip area that are poorly buffered?

A I'm sure there are.

Q Where?

A I don't know precisely, certainly. I know the surface soils generally are certainly much less buffered than the underlying soils.

Q How do they compare to those Canadian soils? Do you know?

A They certainly have a much higher pH than the Canadian soils do now.

Q How about as to the condition of buffers?

A Certainly they are more highly buffered than the Canadian soils are now.

Q Prior to the study that you include in your statement on page 10, again, on line 22, you state that a study early in this century subjected timothy grass to sulfuric acid solutions.

A Yes.

Q With pH's of 2.2 to 3.7 for three years?

A Yes.

Q Do you anticipate that that situation will occur at Colstrip?

A Certainly pH's of 3.7 are possible.

Q Is that for a continuous period of three years?

A Well, throughout the life of the units 1 through 4, yes.

Q Who did the study that you refer to there?

A The senior author's name is Cohen, and the junior author's name is Ruston, and was entitled, "The Study of Smoke in Town Air," published in the early 1920's.

Q How much decreased productivity did that study report?

A I really don't recall.

Q Do you know whether it was less than 5%?

A No, I don't. I don't recall precisely the percentages. Let me just make a note to supply that, if you want?

Q Would you give me that name again?

A Cohen and Ruston. I believe the title of it was, "Smoke: A Study of Town Air."

Q What was the year?

A I believe it was 1922.

Q Have you found any pH in rainfall at the Colstrip area at 3.7?

A No.

Q With regard to your figures on page 11, with regard to the emissions for SO_2 and NO_x --

A Yes?

Q -- are the NO_x emissions calculated from an emission rate of .7 pounds per million BTU for the two plants?

A They're calculated as what was predicted to be emitted in the Board of Health findings of fact, less 20%.

Q Less 20%?

A Yes. Well, less 15 to 20%.

Q Okay. Have you had any review of recent documentation as to what the actual -- or, what the projected NO_x emissions are for units 1 and 2?

A I've seen the results of the Air Quality Bureau's stack measurements at Colstrip at unit 1.

Q And are those measurements far below those predicted for NO_x?

A They're about 40% reduction in what is predicted.

Q With regard to your conversion rates, then, in the next paragraph, how were those conversion rates from SO_2 to sulfates measured?

A Generally the oxidation rates of sulfur dioxide are measured in gas chambers. However, many measurements of the rate of oxidation of SO_2 in actual power plant plumes have been attempted, some successfully and not successfully, so the rates which I report here from .1 to 1% per hour are gas chamber type, and for as high as 30% per hour would have been measured in a power plant plume.

Q Well, the power plant plume was located where?

A On the east coast.

Q Do you know whether or not it was an oil plant, or coal and oil?

A It could have been either one, probably both, most likely oil.

Q Does that have any affect on oxidation rates?

A It's thought that the vanadic particulate which are emitted from oil-fired power plant plumes is more efficient catalyst for the oxidation.

Q In other words, you'd get a faster or a higher rate?

A You'd get a faster rate close to the plant, yes.

Q Who did that study?

A The study that comes to mind was done by, is it Neumann, et al, from the Brookhaven National Laboratories? Their measured rate for the oil plant, though, I believe, was 10% per hour.

Q Same power plant?

A Same power plant as is mentioned in here?

Q Yes.

A I don't know.

Q Now, on page 12, you state that the rate of oxidation, beginning at line 16, of nitrogen and sulfur oxides are in doubt and depend upon many factors?

A Yes.

Q What factors?

A Well, they depend upon relative humidity. It's thought that it depends upon relative humidity. It's thought to be faster in the summertime because the atmosphere can contain more moisture. These particles of acid are hydroscopic. The solubility of SO_2 is limited by pH. The hydroscopic nature of the particles will allow more water to be absorbed, hence more SO_2 to be absorbed and oxidized. It certainly depends on the catalytic content of the atmosphere. It may depend on the ultraviolet photon flux over long distance transport. It may depend on the concentration of NO and NO_2. It may depend upon methane and non-methane hydrocarbons. It would depend upon, probably, upon the free radical concentration. And others, I'm sure.

Q Considering all those factors have a -- play a little part, some part, at least, in the oxidation rates, that makes it very difficult to actually predict any kind of an oxidation rate for a particular plume, does it not?

A It certainly does. It certainly does. Except if you use a factor which -- or, an oxidation rate which has been measured for SO_2 in clean air in gas chambers or is assumed to approximate that which would be reasonably expected, which I have done here.

Q There again, however, that's theoretical as to whether or not the plume -- the SO_2 is really oxidizing at the rate that you use?

A It's theoretical to the extent that it would be expected to occur if we had a mixture of sulfur dioxide, water vapor, and exposed to sunlight. It would be expected that that would be the approximate rate at which SO_2 would be oxidized.

Q Does all sulfate contribute to acid?

A Certainly not. All sulfate particles in the atmosphere are not sulfuric acid. They may be ammonium bisulfate, or ammonium sulfate, and it should be known that ammonium sulfate and ammonium bisulfate are not the -- the acids are not neutralized. These are the particles which are observed on the southern and eastern coast of Sweden, and they are the particles which they are sure have caused increased acidity in soils. This is because when you oxidize ammonium in the soil to nitrate, for each mole of ammonium ion that you oxidize, two moles of hydrogen ions are generated. Since the formula for ammonium sulfate is NH_4 2 SO_4, for each oxidation of a mole of ammonium sulfate to nitrate, four moles of hydrogen ions are generated.

Q Is there any neutralizing effect of mixing with the ambient rain containing carbon dioxide taken into account?

A In this analysis?

Q In your analysis in which you prepared your calculations on

Table 1, which is now Exhibit 241?

A No. Carbon dioxide is not assumed to neutralize any of the acids. I don't quite see how it could do that.

Q You don't take that into account?

A No.

Q In making your calculations on Exhibit 241, which was previously submitted to us as Table 1, first of all, what are the sulfate concentrations corresponding to the indicated pH values?

A I could calculate them quickly for you.

Q Have you done any of them?

A No.

Q There were a number of changes in the numbers, Mr. Tourangeau, why is that?

A If you'll turn to, I think what they've got labeled as Exhibit 242, the first table which I gave to you was only considering half the plume width, so you have to divide the acid concentration by 2, and take the log of that.

Q And that's the reason that you had to prepare the new table?

A Right.

Q Does the same hold true of Exhibit 243?

A Right.

Q What assumptions did you use in making -- in preparing that table?

A Well, the assumptions as I've indicated here: rate of oxidation of SO_2 at half percent per hour; halflife of NO; NO_2 oxidation rate of -- well, halflife of 2 to 3 hours, I believe it is; and that 35% of the SO_2 is present -- or, of the sulfate is present as acid; since nitric acid is a sink for NO_2 in the atmosphere, all the nitric acid was allowed to remain acidic as nitric acid; and that in a one hour, or in an area, subtended by a one hour volume element of the pollutants which are generated from either units 1 and 2 or units 1 through 4, that acid could be removed in .2 or .4 or .8 inch of rain over the area subtended by that volume element. Those are the assumptions.

Q Is there any correlation between the table 241 and the graphs 242, 243?

A The graphs assumed that -- well, let me say, let me tell you one more thing about Exhibit 241. This assumes that the pollutants are uniformly distributed.

Q It does?

A Yes. Uniformly distributed.

Q Do you feel that that's going to be the real case?

A No.

Q But you have to make that assumption?

A Pardon?

Q But you did make that assumption?

A Yes, I did.

Q So that you would have the concentrations at 10 miles that would be the same as those at 50 miles in the plume?

A No, they'd be greater at 50 miles than they were at 10.

Q Why?

A Well, because the plume is traveling for a certain length of time between 10 miles and 50 miles. More acid will be generated; similarly, more SO_2 and nitrogen dioxide would be removed by vegetation.

Q What do you mean, then, by the SO_2, you assume that could be uniformly distributed throughout?

A Yes.

Q At each particular distance?

A Yes. At each volume increment, right.

Q And that, of course, is theoretical? You just don't know how that plume may react at Colstrip?

A Well, that's true, that the pollutants would be uniformly distributed, certainly is an assumption which isn't real.

Q Now, when you say here that the -- so I can understand it correctly -- that the pollutants are distributed in a Gaussian manner in the plume, are you referring in Exhibits 242, 243, and 244 -- 242 and 243 to the Gaussian shape of the plume or are you applying a Gaussian distribution?

A Pollutants are assumed to be distributed about the plume axis in the Gaussian manner.

Q But nevertheless, the concentrations at, say, a half a kilometer from -- a half or one kilometer from the source point, would be less, or greater, than at, say, 50 miles, in your opinion?

A It depends on whether or not it's raining when the pollutants are emitted. This Exhibit 242 and 243, and in fact all the exhibits, do not permit it -- or have not permitted it to be raining when the pollutants are emitted from the plume. That's something that we're going to be working on because Swedish studies have shown that almost all of the sulfur emitted from the city of Upsala, Sweden during rain, was deposited within 60 kilometers, 60 to 90 kilometers.

Q When it was raining?

A When it was raining, yes, deposited as sulfate and strong acid.

Q Doesn't your Table 1, 241, contemplate rainfall?

A Right.

Q Is that .2 of an inch, over what period of time?

A Well, it can be any period of time, probably an hour. That's a pretty good rain.

Q Well, how did you plug it into the equation? How did you plug it in, on an hourly basis, or does it make any difference whether it's for a whole year or one hour?

A This is only the pollutants which were emitted during one hour.

Q And so, likewise, the concentration of rain, or the amount of rain, that you reported on the table, from .2 to .4 to .8, would be for that same hour period?

A Not necessarily. Not necessarily.

Q Where would it differ?

A Well, all Table 1 does is take the amount of acid, on the average, which would be present in any area downwind from Colstrip, and if those pollutants were emitted in one hour, and the plume maintained some kind of an integrity over that period of time, then at any given hour, we would see that much acid pass over a point, or a plane, okay, at a certain distance. If those acids are then rained out, in .2 or .4 or .8 of an inch of rain, these are the pH values which would be expected, provided that the acid was uniformly distributed throughout the volume element. Probably I could have more easily have prepared, what, Exhibit 241 and the graph 244 using the tons of acid passing over a certain distance.

Q Have you made any determination as to the number of times in a year that you would get the rainfall at that specific amount in Colstrip?

A Like .2 of an inch, or .8 of an inch?

Q Yes.

A Certainly you'd get at least that during the spring rains, and you could possibly get more.

Q Or more?

A Yes.

Q What data did you use to justify that statement?

A I used the data which was collected east of Colstrip and at Taylor Creek which is east of Fort Howes, collected this summer by the Colorado state group who are collaborating in the EPA ZAP study.

Q Did they indicate in those reports as to the number of times that they reported on an hourly basis as to when the rainfall during the spring fell at .2 of an inch?

A Per hour?

Q Yes.

A No.

Q And in arriving at your calculations, is the acid in the rain contributed to by the NO_x and the SO_2, or just the SO_2 alone?

A SO_2 and NO_x.

Q In the concentrations that you've reported in your statement?

A Yes.

Q Have you done this similar type of modeling in any area in Montana around an existing source point of emissions?

A I have not, no.

Q Have you -- so, likewise, you haven't been able to compare whether or not the calculations would hold true to any source point in Montana?

A No, I haven't.

Q In your equation that you use on Turner's Workbook of Atmospheric Dispersion Estimates, by EPA, 1970, what is the equation that you use? Is that shown on the top of page 12?

A No, I don't know that that's shown in Turner's at all.

Q Do you know whether or not you used a equation which estimated the ground level concentrations or the plume dispersion?

A I used an equation which estimated the plume dispersion, the width of the plume at a certain distance from Colstrip, and we got those coefficients from Gerald Muller, coefficients A and B for AX^b, which gives the one standard deviation plume.

Q Did you make the calculations that are represented in this table, or did Mr. Muller?

A No, I made them all.

Q Now, how does the table on Exhibit 241, then, correlate to your graphs, if it does?

A You mean to --

Q Did you prepare the graphs from the table?

A Pardon?

Q Did you prepare the graphs from the table?

A Oh, no.

Q Do they correlate at all?

A Correlate?

Q Well, maybe I'm reading them wrong, but, for example, if you take the Table 1 on your revised exhibit there at the line 22, the way I read it for units 1 and 2, the lowest pH you've got at 50 miles, was 5.10; is that right? Am I reading that right?

A Right.

Q And then to go to the graph, where is that figure represented on the graph, if it is?

A Let me try and go over it one more time. What these numbers on Exhibit 241 represent are the pH values which would be measured in the indicated volumes of precipitation if the acid present in a one hour volume element at that distance from Colstrip were dissolved in .2 of an inch of rain falling over the area covered by the volume element. Okay?

Q Yes.

A But Exhibits 242 and 243 show the borders of the areas within the plume element under the same conditions as obtained for Exhibit 241, but if the pollutants were distributed in a Gaussian fashion about the plume centerline.

Q Who has, in your studies, or if you could give me the names of any individuals who have developed the same type of modeling procedure to predict the acid rain concentrations as you have done in your tables and graphs here?

A The basic form of the model, and that is taking those pollutants which are emitted for a certain period of time, transporting them for a certain distance, and making some estimations of ambient air concentrations of sulfate, or oxidation rates of SO_2 or NO_2, there is a model here, Air Quality and Stationary Source Emission Control; that type of model is used by the British to make some kind of an estimation of oxidation rates as sulfur dioxide generated in their country is moved toward Sweden. I don't know of anyone who has applied that type of model to generate pH values, or which would be expected.

Q And has the model been tested in experience or by practice to determine, by measurement, the modeling of the plume as opposed to taking samples of actual rain and trying to correlate whether the model as you have set it forth here would, in fact, be accurate?

A Well, we propose to do that at Colstrip.

Q What I'm asking is, that has not been done?

A Not to my knowledge it hasn't.

Q Well, you'd know if it were.

A I'd hope so.

Q Did you calculate the conversion rates to SO_4?

A Did I calculate the conversion rates?

Q Yes.

A No, I used values which were used by the authors in Air Quality and Stationary Source Emissions Control. The are the average rates which were measured in clean air.

Q Who were those individuals?

A Let me dig them out.

(PAUSE.)

A Dean Warner-North, M.W. Merkhofer.

Q Did you assume that all of the sulfur converted to an acid form?

A No.

Q What is the concentration of the free hydrogen?

A Pardon?

Q What was the concentration of the free hydrogen; do you know?

A At where?

Q In your calculations.

A Concentration of the free hydrogen ion?

Q Yes.

A The concentration of the free hydrogen ion was calculated.

Q You did calculate it?

A Oh, yes.

Q Now, how did you do this? Did you just use work papers, or what was the methodology?

A The methodology was to, because of limitations in computer time, was to crank it out on the hand calculator, to compute the moles of acid which would be passing across time boundary of a volume element within an hour at each end of the volume element, and then I graphed those concentrations, they are a curve, and then determined the average concentration which would pass across it, or which would be present in the volume element for an hour in moles of acid. And because a million liters will fall -- or, a million liters of rain, if it rains for one millimeter, will fall on a square kilometer, we just merely computed the total amount of water which would be expected to fall on the area subtended by the plume covered by a certain volume element, and then you merely dissolve the acid in that. You know the molar concentration of the acid;

you know if it's HNO_3 it's a basic acid; if it's sulfuric acid it's a di-basic acid. There's 99.9% disassociated. And then you compute the molar concentration of hydrogen ions and take the log of that, the negative log of that and its pH.

Q Does this take into account the frequency of occurrence over the period of time in which the meteorological conditions would occur, or is there a frequency of occurrence?

A Meteorological conditions, of course, do vary with some frequency, but how frequently they will vary certainly is not considered in here.

Q Well, would it affect the pH value?

A If it doesn't rain, then certainly there isn't going to be any pH value. The thing to remember here is that if we're out here 25-30 miles from Colstrip, and raining across a volume element, we're continually supplying that volume element with acid. And it may rain further out, and it may not rain further out. So, no, at this stage of the analysis, frequency of precipitation hasn't been factored in.

Q Is there a difference in the terminology used in acid precipitation between washout and rainout?

A Yes, there is.

Q What is that?

A Rainout is a process which occurs in clouds. That's where either particulate with acid adsorbed to it, or indeed, droplets of sulfuric acid can act as cloud condensation nuclei, and so the water which leaves the cloud is acidic. That's rainout. Washout is the phenomena where raindrops remove acid particles suspended in the air below that altitude which the raindrops are formed and condense and begin to fall. Everything which is indicated in here is assumed to be rainout -- washout.

Q Washout?

A Washout.

MR. PETERSON: Could we take a few minutes, Carl?

HEARINGS EXAMINER: Yes, we'll take a recess.

(RECESSED AT 2:35 P.M.)

Following a brief recess, the hearing reconvened at 3:00 P.M. on March 22, 1976.

MR. PETERSON: I have completed my cross-examination.

HEARINGS EXAMINER: Very well. Mr. Shenker?

CONTINUATION OF EXAMINATION OF PHILLIP C. TOURANGEAU

Redirect, by Department of Natural Resources and Conservation, By Mr. Shenker:

Q Mr. Tourangeau, on page 5 of your statement of testimony, there was a reference to a paper which you discussed with Mr. Peterson. Can you give us, again, the name of the author of that paper?

A Just a moment.

Q You said this was a paper that had been presented to Science magazine for publication and had not yet been published; is that right?

A That's correct.

Q Who were the authors of the paper?

A Likens and Bormann.

Q And the subject of the paper?

A The Nature of the Acidity in Precipitation in the Northeastern United States.

Q Has the paper been accepted for publication?

A Yes, it has.

Q When?

A 1976.

Q Now, in your discussion with Mr. Peterson, you told him that you had assumed constant oxidation rates for the purpose of the analysis that you made; is that correct?

A That's correct.

Q You also told him that you assumed the uniformity of the distribution of the pollutants within the plume; is that correct?

A That's true.

Q What was the affect of those assumptions upon your analysis?

A First, it's going to underestimate the conditions which would exist if the pollutants were not uniformly distributed, which it is expected; I think, realistically, that it would not be. And therefore, the pH of the resultant precipitation would be lowered.

Q All right. Now, I'll ask you to assume, Mr. Tourangeau, that you take the plume that comes out from the point source down 20 miles. All right?

A All right.

Q At which point, I'll also ask you to assume, .2 of one inch of rain is measured for one one hour period.

A Okay.

Q Now, is that an assumption that you made for your analysis?

A Yes.

Q What is the affect of that assumption on your analysis?

A No more acidity was allowed to enter the volume element during that period of precipitation. In reality, acidity will be continuously applied, or injected, into that volume element. More acid would be washed out, and the resultant pH's would be even lower than I've shown in my analysis.

Q When you refer to a lower pH, does that mean more acidic, or less acidic?

A More acidic.

Q More acidic. Well, let's back up for just a moment, Mr. Tourangeau, so that we're clear as to the calculations that you had to do for this kind of analysis. Were these all done by hand with you sitting with a pencil and paper?

A No, they were done -- some of them were done on the computer; we tried to get the computer to prepare the graphs so that we wouldn't have to spend that time; and some of them were done on a little programmable hand calculator. They certainly were not done by hand.

Q Were the computer analyses complicated and tedious ones?

A Yes. It requires working at night, sometimes all night, waiting to see the results, finding out whether the computer is adequately able to display what you want it to display. A couple of problems came up which I can maybe discuss now. We asked the computer to confine the plume within the volume element which would be described by the horizontal standard deviation, and then generate the pH isopoles. But the computer was told the pollutants would be normally distributed about the horizontal axis. The equation for that is a cumulative probability density function which requires that there be a molecule of acid in New York City. The computer went looking for it, drawing isopols outside of the volume element. So that was one of problems we had. The other problem was that at the distance which was put on the logarithmic axis, there is no zero on a logarithmic axis, but the stack is at zero, so the computer was told to draw the isopols from zero on out.

The computer crashed. So those are some of the things -- problems that we had.

Q All right. Well, eventually you solved the computer analytic logistical problems, and came up with the analyses that are the bases of the testimony that you've presented here today, sir?

A Yes.

Q And, of course, you conclude in your testimony that Colstrip 3 and 4 will result in greater than minimum environmental impact because of their potential to cause rainwater pH values to be lowered: those which cause abnormalities; those which cause leaching of nutrients; and those which cause injury to surrounding ecosystems. Do I correctly understand, Mr. Tourangeau, that the conclusions which I just read from page 14 of your statement, are a result of the underestimation that you made of the acidic value of the rainwater?

A Yes.

Q What would have been the case if you plugged into the analysis, if there were some way to do it, a faster oxidation rate than you actually used?

A Well certainly the pH values closer to the source will be lower than they are indicated, certainly more acidic. More acid will be converted and the rainwater will be more acidic at any given volume element. The pH's, of course, will certainly be lower.

Q What was the oxidation rate that you used?

A I used a half percent per hour for sulfur dioxide being oxidized to sulfuric acid.

Q Will there be faster rates occurring at Colstrip?

A Yes, there will.

Q What was the assumption that you made as to the uniformity of pollutants?

A We made two assumptions: 1) that the pollutants were immediately upon injection uniformly distributed, evenly distributed, same concentration throughout the area of the plume; and the other assumption 2) was that the pollutants were distributed in a Gaussian fashion, that is, more concentrated at the centerline and becoming more diffuse toward the periphery of the plume.

Q What would be the affect upon your conclusions if, in fact, there was a non-uniform distribution of pollutants?

A Well certainly at the areas where the pollutants are more concentrated, the acids will therefore be more concentrated, and the pH values will be lower than I have indicated and the acidity will be greater.

Q And I think you told us a moment ago that in the real world there will not be a uniformity of distribution in the plume?

A I'm sure of that.

Q And if you were to plug into your analysis an assumption that there would not be a Gaussian dispersion within the plume, from the plume centerline, what affect would that have upon your analysis?

A That's certainly the minimum conditions which I have outlined in my testimony, they will be exceeded.

MR. SHENKER: Nothing further. Thank you Mr.

Tourangeau.

HEARINGS EXAMINER: Mr. Peterson?

Re-cross, by Applicants,

By Mr. Peterson:

Q What would be the affect on the pH values which you have shown, Mr. Tourangeau, if there was, in fact, because of the meteorological conditions, dispersion of the effluent outside of the plume?

A Dispersion of the effluents outside of the plume?

Q Yes.

A I'm sorry, I don't understand the effluents outside of the plume.

Q Well, you have calculated, have you not, or you have assumed a uniform distribution inside the plume --

A Right.

Q -- and one that has immediate distribution across the plume, but yet within the plume --

A Yes.

Q -- and my question is, what if there is a dispersion of those effluents outside of the plume?

A Outside of the plume?

Q Yes.

A And therefore more dilute?

Q Yes.

A Than what would be considered to be the plume boundaries based upon the measurements?

Q Yes.

A Well certainly, then, the acid concentration would be less, and the pH would be higher.

MR. PETERSON: Okay, that's all.

Re-redirect, by Department of Natural Resources and Conservation, By Mr. Shenker:

Q Mr. Tourangeau, how can you have a dispersion outside of the plume?

A I don't know. I don't think you can. I don't understand that.

MR. SHENKER: Okay. Nothing further. Thank you.

HEARINGS EXAMINER: Very well. You're excused. Mr. Peterson, do you have any objections to the proposed exhibits offered by Mr. Tourangeau other than the objection you raised to the time that you received them. I suppose that would apply to the exhibits as well.

MR. PETERSON: Yes, I will object to the introduction of Exhibits 241, 242, 243, and 244 on grounds that they are immaterial and incompetent and based upon speculation.

HEARINGS EXAMINER: Very well. Objections are overruled, and Exhibits 241, 2, 3 and 4 are admitted. Which deposition are you going to start with, Arden?

MR. SHENKER: I have Powe on top. It doesn't matter to me.

HEARINGS EXAMINER: Okay, just so I can find them.

MR. SHENKER: Shall we take them in alphabetical order? Is that easier for you? I have them in whatever order they appear. I have Powe and Wright and Zobel. For the first three it's alphabetical. Then I have Greve, Taylor, Miller and Woy.

HEARINGS EXAMINER: Very well. Mr. Shenker?

MR. SHENKER: At this time, Mr. Davis, the Department of Natural Resources and Conservation will offer as part of its case-in-chief, excerpts from depositions taken during the course of the preparation for these proceedings. The first deponent from whom excerpts are offered is Mr. George R. Powe. The excerpts have been made, delivered to parties, and served as part of the record. In connection with the deposition of Mr. George R. Powe, we also offer as DNRC Exhibit number 36, an exhibit which was made to Mr. Powe's deposition, then marked as Powe Deposition Exhibit number 2, a letter of May 31, 1974, from the Burlington Northern, Mr. Sandgren, described by Mr. Powe in his deposition.

HEARINGS EXAMINER: This is DNR Exhibit number 36?

MR. SHENKER: Yes, sir.

MR. PETERSON: Shall we take them one at a time, or what do you want to do?

HEARINGS EXAMINER: Let's just take them one at a time, because you've got an exhibit in a deposition testimony.

MR. PETERSON: Well, let me say at the outset that I have not had an opportunity to examine the deposition exhibits of Powe, Wright, Miller and Woy. It's not that they weren't given to us timely, other than the fact they weren't given to us before January the 10th, but Mr. Bellingham has handled those witnesses. I think, for the benefit of the record at this time, that I would enter an objection to any testimony relative to Mr. Zobel on the basis that he was present in person and testified at the proceedings, and that any examination of the subject matter sought to be introduced at this time could have been taken up at that time by Mr. Zobel. And therefore, his testimony by deposition is immaterial and incompetent. As to the deposition, the details in the depositions of the other individuals, there are some letters in a couple of the depositions which we would enter an objection to on the record, Mr.Davis, but I think that would be the substance of the objections.

HEARINGS EXAMINER: Very well. Now I will consider, then, that your only objection you're making to the exhibits that have been offered will be to Mr. Zobel's on the basis that he was present and testified and could be cross-examined, and as Hearings Examiner, I've been under the impression that in normal civil procedure under the administrative procedures act, and following the common and statutory rules of evidence, you might have a pretty valid objection. But I've always been under the impression that if a witness, not a party, is present, you wouldn't use his deposition. If I'm -- however, we're not operating under those strict rules under the Utility Siting Act, so I'm going to overrule the objection, and the exhibits and the deposition testimony of each one of these will be admitted. I think if there's something separate you want to comment on on the exhibits, because I'm not familiar with all the exhibits, otherwise let's go through them and get them marked, because we haven't got them marked, and the deposition testimony of Powe and the Exhibit 36 is admitted.

MR. SHENKER: Next, the Department of Natural Resources and Conservation will offer the deposition testimony of Dr. James H. Wright. In connection with the offer of that testimony, we also offer as exhibits, DNRC Exhibit number 37, which was Wright Deposition Exhibit number 4, a memorandum of minutes of March 12, 1973; and DNRC Exhibit number 38, which was Wright Deposition Exhibit number 6, a letter of July 19, 1973 from Dr. Wright; and DNRC Exhibit number 38, which was Wright Deposition Exhibit number 9, a letter of October 3, 1973, from Dr. Wright.

MR. PETERSON: As to each exhibit we object on grounds that they are immaterial and irrelevant.

HEARINGS EXAMINER: Overruled. DNR 37, 38, and 39 are admitted.

MR. SHENKER: Next, we offer the excerpts from the deposition of Eugene S. Zobel, and in connection with that offer, we also offer DNR Exhibit number 33, which was Zobel Exhibit number 13, minutes of a meeting of February 6 and 7, 1975; DNR Exhibit number 34, which was Exhibit 2 to Mr. Zobel's deposition, a time line for work done by the Charles T. Main company; and DNRC Exhibit number 35, which was Exhibit number 5 to Mr. Zobel's deposition, a memorandum of January 17, 1973.

MR. PETERSON: We have no objection to Exhibits 34, and as to Exhibits 33 and 35, we object on grounds that they are immaterial and irrelevant.

HEARINGS EXAMINER: Very well. Overruled. The exhibits are admitted.

MR. SHENKER: Next, with respect to the deposition of Einar Greve, we offer excerpts from that deposition, which was taken pursuant to the subpoena in process in Tucson, Arizona on May 2nd, 1975. There are no offers of exhibits in connection with the deposition testimony of Mr. Greve.

MR. PETERSON: We have no objections.

HEARINGS EXAMINER: I lost you, Mr. Shenker. Are there any exhibits with that deposition?

MR. SHENKER: No, sir.

HEARINGS EXAMINER: Very well. Deposition testimony admitted.

MR. SHENKER: Next, with respect to the deposition of Chester C. Taylor, we offer excerpts from that deposition; there are no offers of exhibits in connection with that deposition testimony.

HEARINGS EXAMINER: Very well. It's admitted.

MR. SHENKER: Next, with respect to the deposition of Robert L. Miller, we offer excerpts from that deposition and there are no offers of exhibits in connection therewith.

HEARINGS EXAMINER: It's admitted, subject to your overall objection.

MR. PETERSON: Okay.

MR. SHENKER: And finally, the excerpts from the deposition of Frank V. Woy. Excerpts therefrom are offered as testimony at this time; there are no exhibits in connection therewith.

HEARINGS EXAMINER: Admitted.

(THE BEFORE ADMITTED DEPOSITION TESTIMONY WAS DIRECTED TO BE INSERTED AT THIS POINT.)

EXCERPTS FROM THE DEPOSITION

OF

GEORGE R. POWE

BEFORE THE BOARD OF

NATURAL RESOURCES AND CONSERVATION

STATE OF MONTANA

- -

In the matter of the Application of the Montana Power Company, Puget Sound Power and Light Company, Portland General Electric Company, the Washington Water Power Company, and Pacific Power and Light Company for a Certificate of Environmental Compatibility and Public Need.

- -

Deposition of GEORGE R. POWE, taken pursuant to Stipulation of Counsel, taken before Robert W. Walsh, a Notary Public, in and for the County of Ramsey, State of Minnesota, on Monday, the 19th day of May, 1975, commencing at approximately 1:30 o'clock in the afternoon at 175 East Fourth Street, in the City of St. Paul, Minnesota.

* * *

APPEARANCES:

ARDEN E. SHENKER, ESQUIRE, Standard Plaza, Portland, Oregon, appearing on behalf of the Department of Natural Resources and Conservation for the State of Montana.

MELVYN M. RYAN, ESQUIRE, 40 East Broadway, Butte, Montana, appeared representing the Montana Power Company.

RONALD F. WATERMAN, ESQUIRE, 301 First National Bank Building, Helena, Montana, appeared representing Burlington Northern.

* * *

WHEREUPON, the following proceedings were duly had:

* * *

GEORGE R. POWE,

a witness in the above-entitled action, after having been first duly sworn, deposes and says as follows:

DIRECT EXAMINATION

BY MR. SHENKER:

Q Mr. Powe, would you state your full name and present residence address for the record, please?

A George R. Powe, 2690 North Oxford, Apartment 244, St. Paul, Minnesota.

Q By whom are you presently employed, Mr. Powe?

A Burlington Northern.

Q How long have you been so employed?

A About twenty-two years.

Q What is your present job function with the Burlington Northern?

A I am Assistant Vice President of Commodity Marketing, and I work primarily on unit transportation of coal and ore.

Q How long have you had that job function with Burlington Northern?

A About five years.

Q And how long have you been an Assistant Vice President with the Burlington?

A About seven years.

Q What did you do with the Burlington Northern before you became an Assistant Vice President?

A I was Assistant Vice President of Minerals for the Northern Pacific Railway Company, one of the predecessor companies.

Q How long were you so employed?

A From 1969 until merger time.

Q When was that?

A March 3, 1970.

Q How long before 1969, when you were an Assistant Vice President with the Northern Pacific, were you employed with the Northern Pacific?

A Sixteen years.

Q And with the Northern Pacific, Mr. Powe, what was the general nature and rank of your duties?

A I was a geologist for Northern Pacific, then was transferred to the coal mines at Roslyn, Washington where I was Assistant Resident Engineer and Assistant Mine Superintendent for about four and a half years. I then came to St. Paul as Chief Mining Geologist for the Northern Pacific in 1953; was promoted to Manager of Mining Properties about 1956; became Assistant General Manager of Properties and Industrial Development in 1964; continued in that until I became Assistant Vice President for Minerals in the Traffic Department.

Q Prior to the time that you became an Assistant Vice President with the merged Burlington Northern Railroad did you concern yourself at all with the studies and concerns with respect to unit trains for shipment of coal?

A Yes.

Q For how long had you so concerned yourself?

A Possibly five years.

Q Then in all would it be a fair statement that for the last ten years you have been studying the use of unit trains for shipment of coal?

A Yes.

Q Is there presently anyone at the Burlington Northern senior to you who has any greater responsibilities on an ongoing basis for the study and evaluation of the use of unit trains for shipment of coal?

A Mr. R. W. Morrison, Assistant Vice President, Energy & Metalics, is the head of our department.

Q How long has he been the head of that department?

A About six months.

Q Now does the nature of your current responsibilities with respect to an evaluation, unit evaluation for coal hauling require you in the ordinary course of your business to look at the economics of coal hauling versus other alternatives for transmitting the results of burning coal in a power plant?

A Yes.

Q Does that include, Mr. Powe, looking at the comparative economic alternatives of hauling coal by rail as against transmitting coal by extra high voltage for ultra high voltage transmission lines from mine mouth power generating facilities?

A Yes.

Q As a result of the exercise of your duties in the ordinary course of your business have you drawn conclusions with respect to such economic comparisons and alternatives?

A Not definitively.

Q Can you tell me something about the nature of the conclusions that you have reached if they are not definitive?

A We believe that it is possible to be competitive with rail service with the other modes of transportation now in existence.

Q Are there any limitations to that belief as fixed in geographic areas in the West?

A Not in particular.

Q If I were to ask you to hypothesize with me the shipment of coal from Colstrip, Montana to load centers on the West Coast of the United States would your answer be the same when comparing such transfer of coal by rail with the transmission of power by transmission lines from a mine mouth generating facility at Colstrip, Montana to load centers on the West Coast of the United States?

I think the answer would be the same.

Q What are the longest hauls for which you now have existing contracts with utilities?

A We do not have contracts with utilities. We have tariffs filed for hauling their coal. We had transported coal by unit train from Decker Coal Company at Decker, Montana to plants of the Commonwealth Edison Company, Chicago Airfield. The distance is about twelve hundred fifty miles.

Q Are you aware of unit trains which haul coal for longer distances even though not on Burlington Northern trains?

A No. Union Pacific has some unit trains operational on comparable distances, and did have one from a further distance but it is no longer in operation.

Q When did the hauling of coal by unit train begin as any kind of substantial operation for railroads?

A Oh, roughly ten years ago.

Q During that time have there been improvements in the method by which unit trains would haul coal with respect to the in gathering of the coal and the shipment and the delivery of the coal?

A The unit train has been developed into a specialized train wherein the mine has fast loading facilities, usually capability to load in rates of three thousand, up to five thousand or more tons per hour. The train is retained as a unit, taken to destination, and usually unloaded at rates of three thousand tons an hour or more. That is the principal improvement in unit train is the fast loading, the fast unloading and the retention of the train as a unit.

Q Has the nature of the car used in the unit trains changed over the years since they began operating?

A Not materially, except in some specialized installations where rapid discharge types of automatically dumped cars have been developed, and these trains, cars have a capability of dumping one hundred tons of coal in about fifteen to twenty seconds.

Q Has there been any development of cars made of a lighter weight than the original cars that were used for unit trains?

A Aluminum cars have been and are being used in unit train service.

Q And are they of a lighter weight than the original steel cars that were used?

A They are lighter than steel cars.

Q What is the approximate difference between steel and aluminum cars in weight?

A It would depend upon the car design, but Burlington Northern operates with one set of unit train cars and the approximate difference in weight is five tons. The aluminum car is ten thousand pounds lighter.

Q What is the capacity for coal carriage by any single car on a unit train run by Burlington Northern?

A The cars have a nominal capacity of one hundred tons, can be made to carry slightly more than that on the steel cars, and our aluminum cars are rated for one hundred five tons.

Q That's what they are rated for?

A Yes.

Q Can they actually carry one hundred five tons?

A They can carry more than one hundred five tons.

Q And that's one hundred five tons of coal not including the weight of the car itself?

A That's tons of coal.

Q Approximately how many cars are there in the unit trains which Burlington Northern now operates to carry coal from the Western Energy Mines in Colstrip, Montana to the Illinois area?

A We are not presently carrying coal on that route. We have carried, and I will answer it on that basis.

Q Fine.

A Normally it has been one hundred to one hundred five cars.

Q How many locomotives are necessary to pull those one hundred to one hundred five cars?

A Five.

Q Five. Have you done any studies on the expected necessity for the number of unit train locomotives that would be used if you were hauling coal over the mountains west from Colstrip, Montana?

A Yes.

Q How many locomotives would that require?

A We are presently looking at 75, maximum 78, car trains to run westward, and the locomotives to get over the worst grade I am informed would be seven.

Q Seven locomotives?

A For 75 cars.

Q Has Burlington Northern engaged in studies with respect to the utility or wisdom or desirability of electrifying rails?

A Yes.

Q Are those studies on an ongoing basis?

A Yes.

Q Do you have any preliminary conclusions as to the wisdom, utility or desirability of such electrification of the rails for unit train hauling?

A This study is an ongoing study and the company, as far as I am aware, has not made a conclusion.

Q All right, how long has the study been going on?

A I don't know exactly but it has been ongoing for more than a year.

Q Has there been independent contractors hired to conduct some of the studies?

A The study is being conducted with General Electric Company.

Q In the course of the projections that you have made for the hauling of coal by unit trains, have you given consideration to the escalation of freight rates over the years?

A Yes.

Q What do you project as a reasonable escalation of freight rates over the years on unit train hauling?

A We do not engage in long range projections. We have an escalator provision in our agreements with the companies for whom we are operating unit trains.

Q What are those provisions now?

A The provision is for an annual escalation of the coal rate based on the Association of American Railroads Comprehensive Index for labor, materials, fringe benefits. This is an index that is published annually, and we base the change in rates upon one hundred percent of that index change until a gall movement starts with unit trains. If it is an existing move we take eighty percent of the index change and apply that percentagewise directly to the rate.

Q Do you have any present recollection of what those index changes are?

A Yes.

Q What are they, sir?

A The index last year increased 14.55 percent.

Q If you would turn to page 8 of Exhibit 12, please, Mr. Powe. I will ask you to assume that page 8 of Exhibit 12 states in graphic form that the cost of shipping coal from Colstrip, Montana to a load center in the State of Washington by rail would be two billion two hundred twenty-one million dollars over a period of thirty-seven years, and the cost of transmitting power by wire from a mine mouth facility in Colstrip, Montana over an equivalent distance and over an equivalent period of time is one billion eight hundred thirty million dollars. Now looking at those figures would you agree with me, sir, that if that were true that the shipment of coal by rail would not be competitive with the transmission of power by wire?

A I would conclude that.

Q If you would look at page one of Exhibit 13. Again

I will ask you to assume that that page states that the cost of shipping coal by rail began with a cost of one billion five hundred thirty-four million dollars for a comparison of plants at Colstrip with 500 KV transmission, as stacked against the cost of plants outside the State of Montana with rail shipment of coal at one billion one hundred thirty-two million dollars over a period of forty-two years. And continuing to page 11 of Exhibit 13, I would ask you further to assume that the cost of shipping coal through Montana over that same period of forty-two years would be approximately forty-five million dollars on an annualized levelized basis as compared to the cost of approximately sixty-five million dollars on an annualized levelized basis for erecting mine mouth generating facilities at Colstrip, Montana with 500 KV transmission. Now having made those assumptions, and assuming that those figures tell you the impact in economic terms of shipping coal by rail versus the shipment of coal through power lines after the transmission of power at mine mouth generating facilities, would you agree with me that those figures state that the impact is greater in economic terms than the transmission of power by wire from mine mouth facilities than by the shipment of coal by rail?

A That's what this purports to say, sir.

Q All right, now do you agree that in order for the shipment of coal by rail to be competitive with the shipment of power by wire from mine mouth generating facilities that it would be necessary to include in your competitive economics the impact of the costs both on a capitalized investment and an annualized operation?

A Yes.

Q At the present time, Mr. Powe, is the Burlington Northern engaged in ongoing discussions with representatives of any of the five utility companies that I previously have mentioned as applicants in this proceeding on the subject of hauling coal by unit train?

A Yes.

Q With which of those five applicants?

A Portland General Electric.

Q And those discussions and negotiations are an ongoing basis at this time?

A Yes.

200,000 pounds, and that may or may not be the full visible capacity of a car depending upon the weight of the coal that you are hauling.

Q Are you presently engaged in any studies here at Burlington Northern responsive to the ICC ex parte order to which I previously referred?

A I don't know.

Q Are you personally at work on any such subjects?

A No.

Q Is it your opinion, Mr. Powe, that it is necessary to structure the rates on coal hauling from the general area surrounding Colstrip, Montana in such a fashion as to give full consideration to the future needs of the industry's present and potential within the Rocky Mountain Upper Missouri River Region?

A I don't follow your question, I am sorry.

Q That's all right.

A Do you want to try it once more?

(Question read.)

A Yes, we recognize that.

Q (By Mr. Shenker) Do you know Mr. R. S. Sandgren?

A Yes.

Q Who is he?

A He is the Director of Pricing in the Energy & Metalics Section for coal.

Q Have you had an opportunity to review with Mr. Sandgren, or, independently by yourself, the approximate distance in rail miles from Colstrip to Spokane, Washington?

A Yes.

Q What is that?

A I don't remember. I have reviewed it more than once. It's in the range of seven hundred miles.

Q All right. And to Portland, Oregon by rail?

A My recollection is the range is about nine hundred plus.

(Powe Deposition Exhibit No. 2 marked for identification.)

Q (By Mr. Shenker) Mr. Powe, we have had handed to you what has been marked for identification as Exhibit No. 2 in connection with your deposition a letter dated May 31, 1974 to Mr. James M. Falvey, F-A-L-V-E-Y, with the Montana State Department of Natural Resources and Conservation from Mr. Sandgren, the Director of Pricing here at Burlington Northern. Have you seen that letter previously, sir?

A Yes, sir.

Q Have you reviewed it prior to the taking of your deposition today?

A I read it with Mr. Sandgren at the time it was written.

Q Would you agree that the projected estimate or representation of rates as stated in that letter were at that time accurate?

A That was a good estimate at that time.

Q And by what factor would you say that that estimate has changed today, if at all?

A The estimate would change by about fourteen percent upward.

Q (By Mr. Shenker) Now, Mr. Powe, returning to the language which you used, sir, at the early part of this deposition when I inquired as to your general conclusions with respect to the competitiveness of the hauling of coal by rail as compared to trans-shipment of power by wire, what do you mean by the term competitive?

A In our judgment the cost of transporting coal by rail is as cheap or cheaper than the cost of transporting the energy by any alternative method.

Q And does that comparative judgment include, with respect to the hauling of coal by rail, both capital investment and operating annual costs?

A Yes.

Q And does it include, with respect to the transmission of power by wire, similarly both capital investment and annual operating costs?

A Yes.

BURLINGTON NORTHERN

MARKETING DEPARTMENT
Market Development Division

Energy, Metallics & Chemicals Section

176 East Fifth Street
St. Paul, Minnesota 55101
Telephone (612) 227-0911

RECEIVED
JUN 1 1974
MONT. DEPT. of NATURAL
RESOURCES & CONSERVATION

Mr. James M. Falvey, Economist
Cultural Science Bureau
Energy Planning Division
Montana Department of Natural
Resources and Conservation
32 South Ewing
Natural Resources Building
Helena, Montana 59601

May 31, 1974

Dear Mr. Falvey:

In your letter of May 14 you have outlined your request for some indication of what unit train rate level could be established by Burlington Northern for moving coal from Colstrip, Montana to a western destination. Since our original reply of April 15, we have had under study such rate matters to a destination in Oregon with routing via Spokane, thence the Union Pacific beyond.

If we could consider Spokane as a destination from your study, you could use the following detail:

Rate per Net Ton
2,000,000 Tons - 735¢
4,000,000 Tons - 735¢
6,000,000 Tons - 730¢

Car Ownership - BN
Train Size - 78 Cars
Transit Time R/T - 108 Hours
Loading Time - 4 Hours
Unloading Time - 4 Hours
One Way Distance - 773

The above rates should be representative if you want to project the ton-mile revenue to other locations served by BN other than Spokane for the same or greater miles. To Portland, for example, for a distance of 1,050 miles, the 2 million ton rate would be 998¢ per net ton.

If further information is necessary, please let us know.

Yours truly,

R S Sandgren

R. S. Sandgren
Director of Pricing

cc: Mr. W. E. Taylor, Billings

File: M. 2000.1

EXCERPTS FROM THE DEPOSITION

OF

JAMES H. WRIGHT

Copy

bm.ma

BEFORE THE BOARD OF NATURAL RESOURCES AND CONSERVATION

OF THE

STATE OF MONTANA

- - -

IN THE MATTER OF THE APPLICATION OF
THE MONTANA POWER COMPANY, PUGET SOUND
POWER & LIGHT COMPANY, PORTLAND GENERAL
ELECTRIC COMPANY, THE WASHINGTON WATER
POWER COMPANY and PACIFIC POWER & LIGHT
COMPANY
FOR A CERTIFICATE OF ENVIRONMENTAL
COMPATIBILITY AND PUBLIC NEED

- - -

Deposition of JAMES H. WRIGHT

Wednesday, March 26, 1975

- - -

The deposition of JAMES H. WRIGHT, called as a witness, taken before me, the undersigned, Holly Monroe, a Notary Public in and for the Commonwealth of Pennsylvania, at the offices of the Westinghouse Environmental Systems Department, Monroeville Mall, Monroeville, Pennsylvania, commencing at approximately 9:00 o'clock a.m., the day and date above set forth.

- - -

APPEARANCES:

On Behalf of The Montana Power Company:

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On Behalf of the Northern Cheyenne Tribe:

Burditt and Calkins:
Tom Scheuneman, Esq.
135 S. LaSalle Street
Chicago, Illinois 60603

ALSO PRESENT:

Robert J. Labrie
John T. Evans
Harold M. Beisel
J. D. Voytko

JAMES H. WRIGHT

called as a witness, having been first duly sworn, as hereinafter certified, was deposed and said as follows:

EXAMINATION

BY MR. SHERIDAN:

A.

Q

A.

Q What is your position now with Westinghouse?

A I am director of the environmental systems department.

Q And when did you become director of the environmental systems department?

A When it was established, in 1969.

Q When did you join Westinghouse?

A 1956.

Q Dr. Wright, the decision had been made to construct Colstrip units 3 and 4 by the applicant companies, had it not, prior to the time Westinghouse was retained to make an environmental analysis.

A. Yes, that is true.

Q Did you envision the role of Westinghouse and your department, in the preparation of the environmental analysis, at this point to be one of analyzing environmental impacts based upon substantial inputs of information and data from the applicant companies, themselves?

A. Yes. Yes.

(Thereupon, a document captioned in handwriting on the title page "W.E.S.D.", with date on cover page of 3/12/73 was marked for identification as Wright Deposition Exhibit No. 4.)

B

Q

Q This particular document consisting of six pages, which has been marked Wright Deposition Exhibit No. 4, is representative, then, of what form of report?

A It is probably representative of a meeting, very broad meeting with lots of people, in which we would get the information as best recollected.

When there is a lot of people in the room, you need to have some recollection of what the key points were.

Q Okay. And you would receive these in the course of your supervisory duties, is that correct?

A Yes.

Q May I please have it?

This document reports that you were present at a meeting referred to in the report.

A Okay.

Q And do you recall being present at that meeting, from your review of the document?

A Yes, I do. Yes.

Q On page 1 of the document marked Deposition Exhibit No. 4, you will see a section regarding improvement of Montana Power Company's image.

A Yes.

Q Okay. Can you explain what the concern of Montana Power was at that time, as related to you by persons in attendance?

A Well, I always suspicion my client has conducted himself over the years in such a way as to not have gained a great deal of friends in the community. If that presumption is wrong, we are way ahead.

But until this environmental movement came along, late '69, utilities did pretty well what they pleased, as most of the other industries did, and as we have viewed and interpreted the NEPA, National Environmental Policy Act, in '69, it is just a new definition of social responsibility, and I view that one of the key things that we have to work with all our clients on is the development of concepts of social responsibility; you know, the arguments that the electric company has a broader responsibility than producing electric power, and this is a part of the thing that I believe we were told by several sources that Montana Power may have had a bad image in Montana.

Q Do you recall whether or not that report, as memorialized in these minutes, was transmitted by Montana Power Company representatives?

A By Montana to us; yes, I believe that was one of the sources. There were outside sources, as well.

Q However, it does state, does it not, in paragraph A of page 1 of Wright Deposition Exhibit No. 4 that Montana Power Company did not desire to make an effort at that time to improve its image?

A That is what it stated. I have the distinct recollection at the meeting that there was division on that point.

This is Mr. Voytko's statement of that meeting. Mine would have been a little different.

Q In substance, you agreed with some recollection of a dispute?

A I agree that there were those in Montana Power Corporation that maintained this position, but there were others that did not.

Q On page 2 of the minutes of the March 12, '73 meeting there is a comment by Mr. Knight which states in substance, I believe, that if the 600-day waiting period occurs, that Colstrip units 3 and 4 are dead.

Do you recall that statement being made by Mr. Knight in your presence?

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A No, I do not.

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All right. Sir, referring back to Wright Deposition Exhibit No. 5, you make the comment, "Present actions by legislators and attitudes expressed by key state administrative agencies suggests that major problems exist with the state government."

Paragraph 3.

What particular problems are you referring to, and where did you obtain that information in support of that?

A Well, at the outset of our project, for example, there was no -- as I recall, the Montana State Legislature, and eventually the government, signed into law the Power Plant Siting Act, after our job was undertaken.

Our initial scope was developed and based on our understanding, interpretation of the federal requirements for an environmental report; that the state action which was taken clouded the issue in a number of ways; in an attitudinal way, which indicated that there was, on the part of some, concern with Montana Power and with power plants.

And secondly, there then existed under law the requirement for an environmental report for which no specifications of any sort had been prepared, for that matter maybe not until this day, but certainly not as of a year ago, none had been prepared to guide the applicant in what was to be required in the state report.

So it represented a major new intrusion in the development of technology and remained an unknown point throughout the course of the study.

(Thereupon, a letter dated October 3, 1973, to George O'Connor from James H. Wright, was marked for identification as Wright Deposition Exhibit No. 9.)

BY MR. SHERIDAN:

Q Dr. Wright, I am handing you what has been marked Wright Deposition Exhibit No. 9, which purports to be a letter dated October 3, 1973, to Mr. George O'Connor of the Montana Power Company, signed by you, and ask if you can identify that document.

A Yes.

Q Okay. And was that letter sent to Mr. O'Connor?

A Yes.

Q You also make the comment on page 2 that the other camp, continuing from the sentence regarding Wicks, "... and the power structure, led by Christiansen, who are earnestly trying to make the best decisions for Montana's future."

You continue to say, "I have the distinct feeling that the meeting would have been considerably different had Christiansen not attended, and that is precisely why he did attend."

A Again, that is certainly my opinion.

Q Did you discuss the reasons for Lieutenant Governor William Christiansen's attendance at the meeting with him?

A I don't know whether it was then or earlier or later, but the Lieutenant Governor had been given the responsibility, I believe by the Governor, to look into energy matters, if not energy policy, for the State of Montana, and I have a very high regard for Lieutenant Governor Christiansen in his open-minded efforts to seek facts and to put them together.

He may put them together a different way from what I do, but I am certainly convinced that he has tried to consider all the data in his decision process.

Q What is the corporate purpose of the Power Systems Company?

A It is to maintain business, primarily in the electric utility sector here in this country and around the world.

Q Do I take it that means to manufacture, market, sell and assist in the installation of, among other things, electrical generating equipment?

A Yes, electrical generating equipment, nuclear power equipment, transmission and distribution equipment.

Q And hopefully to make money in those activities?

A That is a dear hope.

Q But it is a hope?

A That is the intent.

Q That is what you go in business for, isn't it?

A That is correct.

Q And you are part of that undertaking, aren't you?

A Yes.

Q You indicated that a number of applicants had personnel who had been trained at your school at Fort Collins.

A Yes.

Q Do you have an opinion as to whether the technology of SO_2 scrubbing has been demonstrated for large scale commercial application on coal-fired power plants?

A Yes. I feel that it is at best marginal.

Q I see.

Page 1-1 of that environmental analysis, referring to the far left column of the very bottom paragraph --

A Okay.

Q -- states that, "In early 1973 Westinghouse Environmental Systems Department was engaged to conduct a comprehensive environmental analysis of the entire project, and compiled this environmental impact report."

Are you satisfied that your department did conduct a comprehensive environmental analysis of the entire project?

A I certainly am.

Q Let me ask the question: The Board of Natural Resources, you understand, is the decision-maker in this proceeding?

A Yes.

Q As distinguished from the Department of Natural Resources --

A Yes.

Q -- whom you see represented here today?

A Yes.

Q Now, you have told us you have a lot of views, and social values from your perspective in a lot of subjects, is that correct?

A I think everyone does.

Q Now, what about based on your knowledge of what is going on here and what is at stake and what is involved, do you have a view as a socially concerned person whether that is a highly relevant question?

A Relative to what, sir?

The world is full of problems that will never be worked on because of relative priorities.

Sure, it is important.

Q From the same perspective?

A More in depth study of the Crow is important.

Q I agree with that, too.

By the way, they are not in here, either, are they (indicating)?

A There is an enormous amount of studies that can be done; what their relative priority is, is a function of the budget level and the scoping of the job.

Q Is the implication of that last statement that the Northern Cheyenne and the Crow were of a relatively low priority, given budget and scope of the job?

A No, not at all.

Q It is not?

A No.

Q How does your last statement relate to what we have been talking about?

A Your question has been dealing with the importance of a larger study on the Cheyenne.

As a scientist, I want to study everything in a lot more detail; wind power, solar power; I have a whole variety of things for which nobody is willing to find a budget for.

W. 6 & 10.

DNRC Ex. 37

File
Internal Correspondence
Meeting / Minutes

Title

Date

3/12/75

Wright
Deposition
Ex. No. 4

-8649-

Voytko
Deposition
Ex. No. 5

From :ESD-COLSTRIP-29
WIN :236-5973
Date :March 15, 1973
Subject MINUTES OF MEETING BETW
COLSTRIP UTILITIES AND
WESD ON MARCH 12, 1973

W ENVIRONMENTAL SYSTEMS DEPARTMENT

To: J. H. Wright
J. G. Terrill
H. M. Beisel
M. B. Blinn
A. J. Krause
A. P. Lundberg

cc: Central File C262

The following people were in attendance at the subject meeting:

Montana Power Company

Messrs. J. T. Evans, R. A. Hofacker, C. R. Anderson, R. Labrie, M. Ryan, J. A. McElwain, W. H. Coldiron, W. G. Kelley and Ross.

Other Utilities

Messrs. A. Armstrong and Eichter of PGE and Messrs. Knight and Porter of PPL.

Westinghouse

Messrs. J. H. Wright, J. G. Terrill, E. W. Sucov, B. Cowan, H. M. Beisel and J. D. Voytko

A. WESD presented our approach to disciplines other than environment (see attachment). These were reviewed with only minor comments and constructive suggestions except for Item VII (Public Communications Program). In this case, MPC decided they did not want to participate ✓ in developing new approaches toward improving their image, at this time.

B. Bonneville ACTION - Terrill

The Bonneville Power Administration owns the Hot Springs substation and will enter into the proposed Wheeling Contract with PPL and PGE. Therefore, it is considered necessary to establish ✓ an interface for the Colstrip project shortly. My understanding is that the following persons will be involved: Ralph Gens, Systems Engineering, BPA, Portland; Ron Wilkerson, BPA, Kalispell; and Harold Harding, WWP, Spokane (now represents 4 utilities in dealing with Bonneville).

C. Montana Dept. Of Natural Resources & Conservation ACTION - Terrill/Voytko

After a copy of the legislation is received and studied, WESD will establish an interface with Gary Wicks, Head of the Department.

D. Schedule of WESD Action on Socio-Economic and Agency Problems

May 1 - Present to utilities our program and preliminary assessment of Colstrip project.

May 5 - Present above program to Department of Natural Resources and Conservation.

May 10 - Present program to state government agencies, get feedback, correct and re-direct program if necessary.

E. Joseph A. McElwain Presented MPC's View of Problem Areas

Industrial development of eastern Montana conflicts with territorial agricultural development. Conservative people are afraid that industry will come in, alter the tax base, then leave. Affluent outsiders enter and want to stop everyone else from coming in.

Academic community is becoming more liberal. They want to stop industrial development, yet keep existing life styles.

Newspapers, bought up recently by one syndicate. They are biased against industry, especially Montana Power.

Sportsmen want all the game for themselves, doesn't want any other resource developed.

F. D. H. Knight, Puget Power & Light, Comment on Units 3 and 4

"If 600 day waiting period is mandated, units 3 and 4 are DEAD!"
NOTE: The new state siting bill provides for up to 600 days for review of Environmental Report.

Coldiron, MP General Council, is actively seeking an interpretation of the time periods involved in the new power plant siting legislation.

G. Other Legislation

New legislation may be introduced prior to legislative adjournment on March 19, 1973; MPC will send copies to WESD.

JD Voytko
J. D. Voytko
Project Manager

JDV:r
Attachment

ENVIRONMENTAL MEET

COLSTRIP PROJECT

March 12, 1973

I. INTRODUCTION .... Dr. J. H. Wright

Purpose:

1) Present Status Report on the Project

2) Develop Strategy for Decision on Expan of COLSTRIP.

II. STATUS REPORT OF ENVIRONMENTAL PROGRAM .... Jack Voytko

1) Brief Description

2) Hand out Status Report

III. AGENCY COORDINATION .... Jim Terrill

1) Accomplishments to Date

2) Coordination Plan

IV. MODELING SOCIAL IMPACT FOR COLSTRIP .... Dr. H. M. Beisel

1) Social Model Program

2) Specific Attention to Power as a Legiti e Export Product

3) Consideration in Cost-Benefit Analysis

V. SOCIAL VALUES IN MONTANA .... Dr. E. Sucov

1) Development of Items for Survey

2) Development and Approval of Survey Cont

3) to Use the Result.

VI. ENVIRONMENTAL-LEGAL JUNGLE .... Barton Z. Cowan,
(Eckert, Seamans, Cheirn & Mel
Pittsburgh, Pa.)

1) Strategies in Environmental Hearings (T L)

2) Discussion of Recent Federal Actions

3) ana State Laws .

COMMUNICATIONS PROGRAM .... Dr. J. H. Wright

th Carolina Project

nesota

of Universities

INTEGRATED PROGRAM DEVELOPMENT .... ALL

-8652-

WESD-892

estinghouse Electric Corporation Power Systems

(412) 256-7991, 5900

Environmental Systems Department
Box 355
Pittsburgh Pennsylvania 15230

DNRC Ex. 38

July 19, 1973

Mr. George W. O'Connor
President
Montana Power Company
40 East Broadway
Butte, Montana 59701

Dear George:

There are new developments with regard to air pollution implementation plans which I think are of sufficient importance that they should be brought to your attention at this time.

History

As you are aware, the Sierra Club sued Ruckelshaus in 1972 on the basis that the EPA's instructions to the states for an air quality implementation plan did not contain provisions for maintaining air quality in certain regions where that air quality is greatly superior to the national standards.

The Sierra Club won a decision in the District Court in 1972 and the instructions from the judge (to the EPA) were that the EPA should formulate and implement state plans for maintaining clean air regions of the country "without significant deterioration of air quality". The EPA then appealed that decision to the Appeals Court in 1972 and lost their appeal -- the judge in that case finding for the plaintiff again.

This case was then appealed by the EPA to the Supreme Court in 1973 and was heard and reported on in 1973. The Supreme Court had a 4 - 4 split and, in essence, a tie vote by the Supreme Court reaffirmed the Appeals Court decision.

So, the EPA was under pressure to develop and implement state plans regarding "without significant deterioration" of areas cleaner than the national standards.

Wright Deposition Ex. No. 6

Present Situation

The EPA has submitted for comment in the Federal Register as of last Friday, July 13, four potential plans for implementing this "without significant deterioration". Their submittal in the Federal Register establishes four separate exclusive plans.

The Sierra Club's attorney, Mr. Bruce J. Terris, addressed our Fourth Westinghouse International School for Environmental Management this week and pointed out that he was filing another suit against the EPA on the basis that their present action is not responsive to either the law or the Court's decision.

Details of the four proposed plans can be obtained from the Federal Register, or I will forward copies of these plans to you if you so desire.

Future

In addition, Mr. Terris told us that he also entered into suit against the Department of Agriculture and the Department of Interior in order to stop the construction of large numbers of power plants planned for Wyoming and Montana. He will use both the Air Quality Act of 1970 and the various auxiliary arguments in his suit against the Departments of Agriculture and Interior.

/ I have little confidence that these two enormous bureaucracies will be able to present an effective defense against one smart lawyer, and I think it is vital that we determine ways and means of assisting the Departments of Agriculture and Interior on the preparation for this case.

I feel that the definition of "without significant deterioration" and the other law suits that have been filed and are pending could have an enormous effect on the outcome of the Colstrip Project. I know that you and your attorneys would like to be aware of this so that an effective strategy can be formulated.

Sincerely yours,

Jim Wright

James H. Wright, Director
Environmental Systems Department

CC: Mr. D. C. Frisbee, President - Pacific Power and Light Company
CC: Mr. R. M. Davis, President - Puget Sound Power & Light Company
CC: Mr. F. M. Warren, President - Portland General Electric Company
CC: Mr. W. J. Satre, President - Washington Water Power Company

JHW/ak

bcc: J. D. Voyt[illegible]

WESD-1084

stinghouse Electric Corporation Power Systems
(412) 256-7991, 5900

Environmental Systems Department
Box 1899
Pittsburgh Pennsylvania 15230

DNRC Ex. 39

October 3, 1973

Mr. George O'Connor,
President and Chief Executive
The Montana Power Company
40 E. Broadway
Butte, Montana 59701

Dear George:

Your presentation at Big Sky was really great. It set the stage beautifully for the presentations and working sessions emphasizing our common goals.

While such a broad meeting had certain elements of risk, the outcome in this particular meeting was, I believe, of considerable benefit to the Project:

> First of all, it provided an excellent opportunity to communicate results to date with all the key people.
>
> Second, it allowed us to identify the extremists with whom we will have to work. This early disclosure gives us some additional time to develop a specific strategy for these problems.
>
> And, third, it allowed us to gather an impression of the people who may be supportive of the Project, and gives us time to reinforce their affirmative opinions.

My reading of the meeting is reflected as follows:

Federal Situation:

I see no major problem for approval in the federal agencies. The two potential problems of greatest concern to me are:

1) The federal agencies may constitute a schedule problem if they do not specify a lead agency and get in high gear. (Action on this by Jim Terrill and John Ross.)

Wright
Deposition
Ex. No. 9
-8655-

2) The Indians will want special treatment, both in terms of further attention by visits, discussions, etc., and will probably insist on some form of compensation in terms of job training and opportunities and, perhaps, direct compensation.

A Cheyenne, for example, was complaining that Bechtel had selected a Crow as their construction superintendent and the Cheyenne was worried that tribal discrimination would follow. These kinds of things may require especially close supervision of Bechtel and Main by your staff.

State Situation:

The meeting further reaffirmed our concern that the major problem with the Project will be with the State people.

It would appear that the State people are fractionated into at least two camps — the "young turks", led by Wicks, who intend to be as difficult as possible and would not hesitate to reject the Project if they had the power to do so, and the power structure, led by Christiansen, who are earnestly trying to make the best decisions for Montana's future. I have the distinct feeling that the meeting would have been considerably different had Christiansen not attended, and that is precisely why he did attend.

We will continue our dialogue with the state agencies to the maximum extent possible but we are planning to give the Lieutenant Governor and the Head of the State Planning activity our special consideration in developing information for his key issues. Christiansen specified some additional studies which we have undertaken. Jack Voytko is anxious about the impact of Christiansen's request on our delivery schedule and has informed John Evans that it may cause a few days of slippage.

We have a much clearer picture of how the costs and benefits of the Project wil be weighed in the State's decision and can supply additional information on the critical points. While I do not have those data at the present time, I am increasingly confident as to the outcome.

Thank you again for the excellent introduction to the Big Sky meeting.

Very truly yours,

James H. Wright, Director
Environmental Systems Department

JHW/ak

Excerpts from the Deposition of
Eugene S. Zobel

BEFORE THE BOARD (
RESOURCES AND CONSERVATION OF
THE STATE OF MONTANA

IN THE MATTER OF THE APPLICATION)
OF MONTANA POWER COMPANY, PUGET)
SOUND POWER & LIGHT COMPANY, PORTLAND)
GENERAL ELECTRIC COMPANY, THE)
WASHINGTON WATER POWER COMPANY, and)
PACIFIC POWER & LIGHT COMPANY FOR A)
CERTIFICATE OF ENVIRONMENTAL COMPATI-)
BILITY AND PUBLIC NEED)

DEPOSITION OF EUGENE S. ZOBEL

Taken in behalf of the Department of Natural Resources and Conservation and the Northern Plains Resource Council

BE IT REMEMBERED That, pursuant to stipulation of Counsel for the respective parties, hereinafter set out, the deposition of Eugene S. Zobel was taken before Billy P. Ellis, a Notary Public for Oregon, on Thursday, the 20th day of March, 1975, in the offices of C. T. Main Company, Harrison Square, Portland, Oregon, beginning at the hour of 9:00 a.m.

APPEARANCES

Mr. John J. Peterson, appearing in behalf of the applicants;

Mr. Arden E. Shenker, appearing in behalf of the Department of Natural Resources and Conservation;

Mr. Leo Graybill, appearing in behalf of the Northern Plains Resources Council.

ALSO PRESENT

Mr. Robert C. Ender and Mr. John T. Evans

EUGENE S. ZOBEL,

called as a witness in behalf of the Department of Natural Resources and Conservation and the Northern Plains Resource Council, having been first duly sworn, was examined and testified as follows:

EXAMINATION

BY MR. SHENKER:

a

Q Mr. Zobel, on February 6th and 7th, 1975, at the office of the Charles T. Main Company in Charlotte, North Carolina, I understand that a meeting was held for the purpose of reviewing the entire Colstrip project and to examine the effect of personnel changes in the Main Company on the project. Were you present at any part of that meeting?

A Yes.

Q Do you recall a discussion at that meeting, Mr. Zobel, on the subject of preparing testimony from C. T. Main Company for the up-coming hearing in connection with this project?

A Yes.

Q I understand that at that meeting there was a discussion that the Montana Power Company would like to have Mr. Einar Greve testify. Was the scope of his testimony lined out in that discussion?

A I believe it was.

Q He was not present at that meeting, was he?

A No.

Q And in the event Mr. Greve would not be able to testify was it the suggestion from the Main representatives that Mr. Robert Ender would be the most qualified alternate?

A I believe that's true.

Q And actually, Mr. Ender's relationship with the Colstrip project has been in the systems planning, has it not?

A That is his forte, yes.

Q And other than Mr. Greve is there anyone who has been sort of overall in charge of the Colstrip project?

A Well, I think I have answered that question earlier this morning, which I indicated when you showed me the Exhibit No.1 of the organization, that prior to Mr. Greve leaving Charles T. Main he indicated Mr. Chet Taylor would be the Project

Manager, and that is a letter that's in our files. Subsequent to that I believe there was an indication of the meeting in Charlotte that stated Mr. Harkness would be Project Manager.

Q Now, Mr. Harkness and Mr. Taylor were both present at that meeting in Charlotte, were they not?

A Yes.

Q Is there some reason why Mr. Taylor was not designated as the alternate to Mr. Greve, or Harkness perhaps, since they would have the managerial responsibilities of the project?

A It was not for me to decide. I would rather say I can't comment on why.

Q At that meeting the Charles T. Main representatives were asked to undertake specific work in preparation for the hearing, were they not?

A Yes.

Q And I believe it was in three categories, and I want to go over those individually; first, to re-evaluate the need for Units 3 and 4. Do you recall the discussion on that subject?

A Yes.

Q Were you to play any personal role in that aspect of it?

A None whatever.

Q Was it your understanding that Main was to review but not alter the most up-to-date load and resource information available in the Pacific Northwest power pool?

A I think I recall that discussion.

Q And then to prepare the necessary charts and slides and demonstrate the basis for the needs; is that right?

A I think that's correct.

Q Also in connection with this same topic, you were to have -- by "you" I mean Main generally -- were to have analyzed the comments made by the Bonneville Power Administration on the environmental impact statement issued by the Montana State Department of Natural Resources and Conservation in order to critically review that section of the environmental impact statement; is that correct?

A I don't recall for certain that was stated.

Q But on February 10, 1965, this request for work by the C. T. Main Company was withdrawn by Mr. Evans, was it not?

A I don't know the details, who said what to whom, but I know that we told-- I was told verbally by Mr. Nesgos that we no longer had that responsibility.

Q Do you know why?

A No.

Q The second category of work, as I understand it, in which the Main Company was to have been involved in preparation for the hearing was to evaluate the economics of alternate generation, type, size, and location. Do you recall that discussion?

A I think I do.

Q That would require a review of the section of the Environmental Impact Statement dealing with that particular aspect, and also reviewing a study made by Mr. Davenport of the Montana Power Company on a comparison of shipping coal by rail versus the thermal generation at mine mouth?

A Yes, I do.

Q Did you understand the function of the Main Company, as a result of that discussion at that meeting, to be to compile and organize the information so as to effect maximum impact at the hearing on March 17th?

A I don't recall that.

MR. SHENKER: Mark this.

(Five-page copy of Minutes of February 6 and 7, 1975 Meeting was marked Department Exhibit 13, Zobel Deposition, for identification.)

BY MR. SHENKER: (Continuing)

Q Calling to your attention Exhibit No. 13 of the Department in connection with your deposition, Mr. Zobel, and the front of that exhibit purports to be minutes of the meeting of February 6th and 7th in the Charles T. Main offices in Charlotte. Have you seen that document before?

A I'm sure I have a copy of that somewhere in my files. I'm sure I read it.

Q On Page 2 of that set of minutes, in Paragraph (c) (2), do you see the sentence sitting there by itself that says: "Again, MAIN will compile and organize the information so as to effect maximum impact at the March 17 hearings"?

A I see it.

Q Do you agree that is a correct summary of the discussion that took place at that meeting?

A I would have to say that's what it says. It's a record of minutes, then it must have been said.

Q You don't disagree with that?

A No.

Q And that request, too, was withdrawn from Main's responsibility, was it not?

A I don't know. My comments before indicated Mr. Nesgos said certain things had been removed from our responsibility, and specifically whether that was included or not included, I don't know.

Q In any event, that particular aspect was not something on which you would have worked, I take it?

A I don't know. I think it's too general to say whether I did or did not.

Q Did you know who in the Main organization was going to work on Categories 1 and 2 that we have just discussed, those paragraphs numbered 1 and 2 under (c) on Page 2 of the minutes?

A My recollection is that Main would participate in preparation for Item 1; Main would have nothing to do with Item 2, as I remember it. Now, I'm not reading the document as I tell you this. I better see what the document says. But that's my recollection.

Q Okay. Maybe you had better read that part, starting with Paragraph 3. It says: "MAIN was asked to do the following work:"

(Witness examined document.)

A Okay. It says Main would do something in regard to Item No. 2. My recollection of Item 2 had to do with this part done by Mr. Davenport. I thought that was all of No. 2.

Q Do you have any recollection, Mr. Zobel, of who from the Main Company would be designated to work on Items 1 and 2?

A My best recollection is that Mr. Nesgos was going to do the work involved where we needed to do something as far as Items 1 and 2. And since the later agreement was withdrawn, this-- I just don't understand quite why the question, but at any rate it was withdrawn, apparently.

Q As to Item No. 3, the "Summarize impact of transmission," you were to work on that, were you not?

A I was to participate, yes.

Q Is there anyone else from Main who you know who is preparing testimony to give at the hearing on that subject?

A Well, it states here that Mr. Finnegan would do something regarding the impact of unit trains.

Q Is Mr. Finnegan with the Puget Sound Power & Light

Company?

A Yes. He was at the meeting.

Q My question was whether anyone else from the C. T. Main Company is preparing testimony in connection with that Item No. 3.

A Well, there's mentioned here under "Summarize Impact of Transmission": Radio interference, audible noise, EI--Environmental Impact, I suppose that is.

Q Yes.

A This would have to be Mr. Nesgos because this is the area he was concerned with, in preparing the radio noise and audible noise reports, so obviously he would be involved.

Q That paragraph also says: "Appropriate graphs and slides will be made for use at hearings." Have you prepared such graphs and slides for your testimony?

A I have prepared no slides; I have done some work in preparation for taking the witness stand.

Q What kind of work is that?

A Further research on seismic effects on lines, particularly since the DNR report indicated that it was their opinion that insufficient work had been done in this area.

Q Have you prepared any graphs or charts?

A No.

Q Do you intend to?

A I don't plan to, not in that regard, no.

Q Have you prepared any written documents of any kind that you intend to offer with your testimony?

A I think perhaps, yes.

I'd like to ask Mr. Peterson a question.

(Witness conversed with Mr. Peterson.)

THE WITNESS: I have prepared some reports, obtained some pictures, which I have given to Mr. Peterson.

BY MR. SHENKER: (Continuing)

Q Pictures?

A Yes.

Q Of what?

A Pictures taken of fluorescent tubes while standing under EHV lines, pictures of farm land around towers-- existing towers.

Q Where?

A In Southern Indiana.

Q Are they pictures that you took, yourself, or someone took and furnished to you?

A Someone took them for me with my camera.

MR. SHENKER: Do you have those?

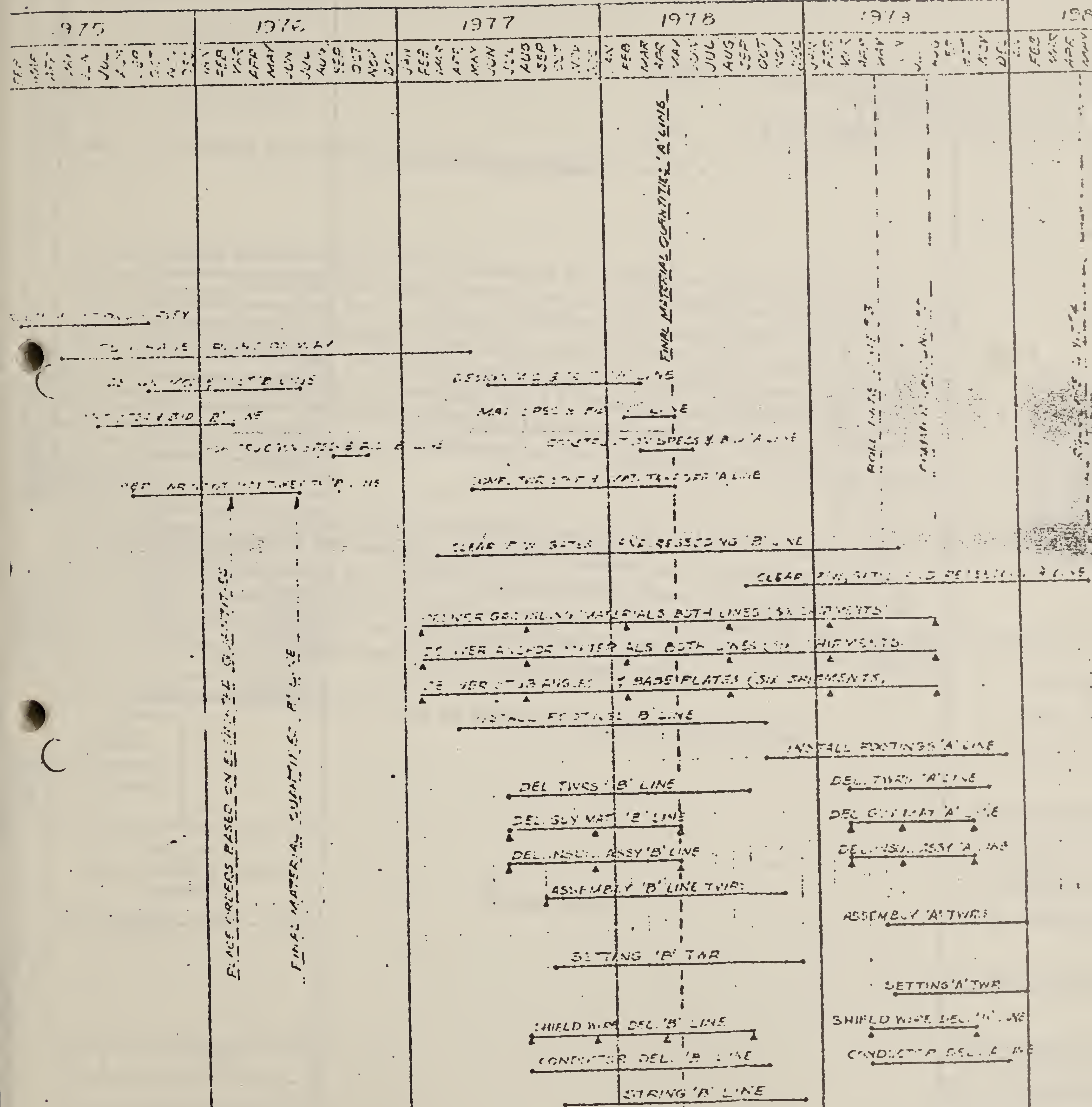
MR. PETERSON: Any of those documents will be exchanged by April 10th.

MR. SHENKER: Fine.

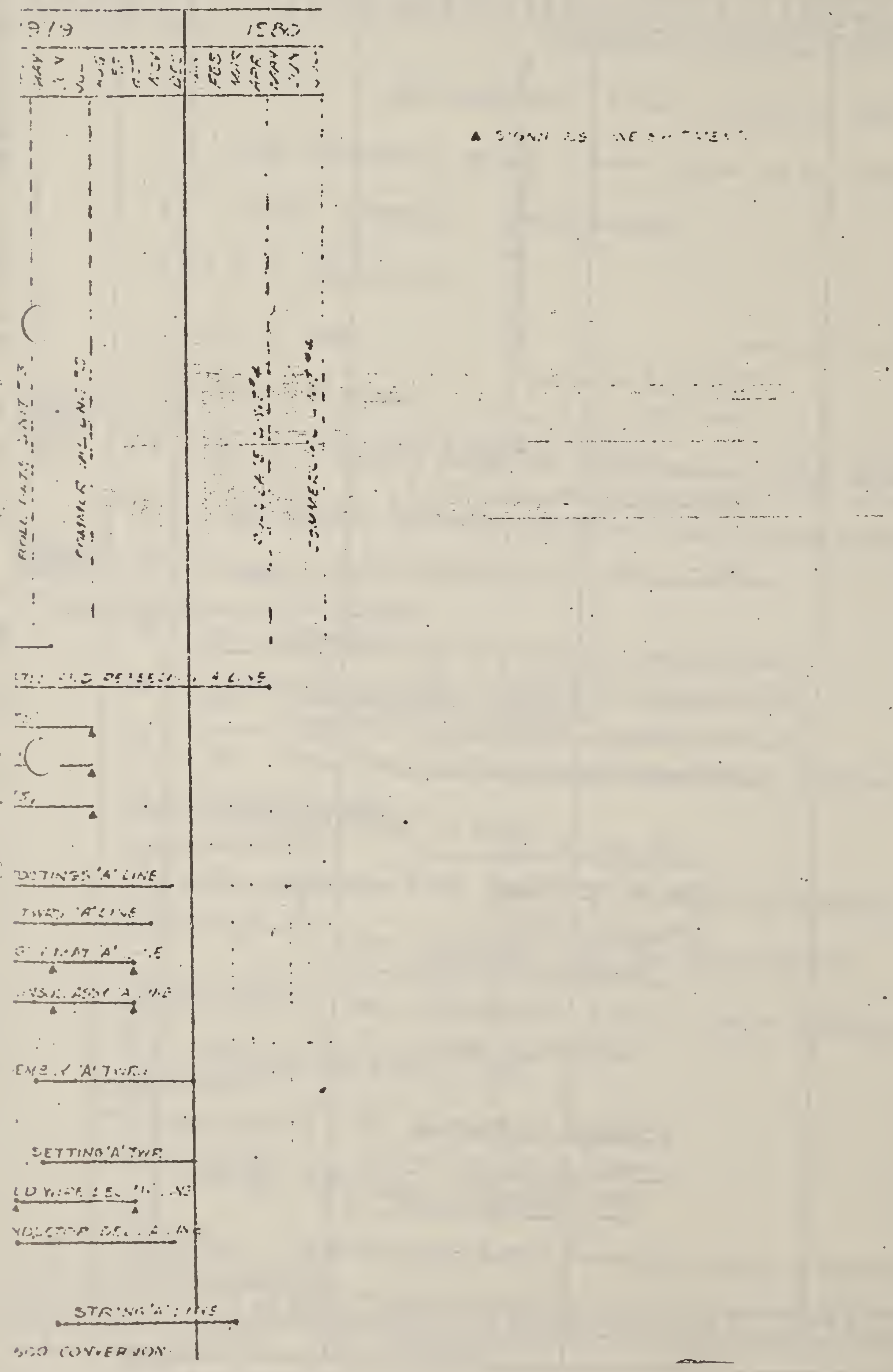
BY MR. SHENKER: (Continuing)

Q I assume you don't have any extra copies of those with

PNRC Ex. 34



Zorel Ex 7



REV	DRAWING ISSUED FOR			

DRAWN BY HENRY CHOCHREK

CHECKED BY

APPROVED BY DESIGN ENGINEER

COORDINATION CHECKER

APPROVED BY DEPARTMENT LEADER

APPROVED BY PROJECT MANAGER

IN CHARGE

P. R. ASKMAN

P. R. HAMILTON

PROJECT MANAGER

MAIN

CHAS. T. MAIN, INC.

Engineers

BOSTON CHARLOTTE DENVER PORTLAND

DEPT TITLE

COLSTRIP PROJECT - 500 KV LINES

DESIGN & CONSTRUCT. SCHED.

REVISED 2/20/79

-8669-

CLIENT

MAIN
CHAS. T. MAIN, INC.
Engineers

DNRC Ex. 35

OFFICE MEMORANDUM

TO: Lillian Eknoian

FROM: Einar Greve

DATE: January 17, 1973

FILE: A 503-23

SUBJECT: Montana 500 kV Transmission Project

COPY

Thank you for your note of January 4. The development of the Montana project started with initial plans for two 350 MW generating units, and later it was decided to add two 700 MW units and to develop a 500 kV transmission system. This final plan was developed gradually during the fall of 1972. While this was going on, however, Montana Power Company submitted a request for a Certificate of Convenience from the Montana Board of Health for the construction of the two 350 MW units. In Montana, this amounts to the same thing as a license to construct a project.

The client expects that this certificate will be issued sometime this spring. In the meanwhile, they are anxious not to introduce the two 700 MW units and the 500 kV transmission plans in the picture at this time, since this might delay the issuance of certificate for the two 350 MW units. Therefore, they have asked us to treat information regarding this project as confidential for the time being.

I will let you know as soon as this restriction is being lifted.

Einar Greve

EG:df

8670-

DNRC Ex. 33

COLSTRIP 500 KV TRANSMISSION PROJECT
MINUTES OF February 6 & 7, 1975 MEETING
LOCATION: Chas. T. Main, Inc., Charlotte, N. C.

PURPOSE

The purpose of the meeting was to review the entire project and to examine the effect of recent personnel charges in MAIN on the project.

ATTENDANCE

The following persons attended the meeting:

MONTANA POWER COMPANY

John T. Evans
W. Haller

PUGET SOUND POWER & LIGHT COMPANY

Leo Finnegan

CHAS. T. MAIN, INC. - Boston

Bruno Zambotti
Howard Barnes
George Nesgos

CHAS. T. MAIN, INC. - Charlotte

D. C. Stewart
E. S. Zobel
R. S. Wolfe

CHAS. T. MAIN, INC. - Portland

M. A. Harkness
C. C. Taylor

DISCUSSION

1. Environmental Impact Statement

(a) A preconference meeting of lawyers is scheduled for February 13 to work out procedures for the hearings.

Montana Power Company would like to have E. Greve testify for them. However, the lawyer's may decide against this approach. MAIN suggested to Montana

Power Company that R. C. Ender would be the most qualified alternate. Montana Power Company expressed interest in meeting with R. C. Ender as soon as possible.

Montana Power Company presented a report from BPA commenting on the State Department's EIS. In general, BPA does not support Department's approach and has questioned the basis of some of the conclusions.

(b) Hearings before the Board of Natural Resources are scheduled to begin March 17.

(c) In preparation for these hearings, and in anticipation of what Montana Power Company's lawyers may want, MAIN was asked to do the the following work.

(1) Reevaluate the need for Units 3 and 4. MAIN will review, but not alter, the most up-to-date load and resources information of each of the participating companies and of the integrated Pacific Northwest Pool (PNWPP). MAIN will also prepare the necessary charts and slides to demonstrate the basis for need. Also, MAIN will analyze BPA's comments and critically review the section of the EIS Report dealing with the need for additional generation.

This re-evalution withdrawn on 2/10/75 By J.T.E

This review to be completed by February 21.

(2) Evaluate economics of alternate generation (type, size, location). MAIN will review the section of the EIS Report dealing with this problem and also review a study made by Mr. D. Davenport of Montana Power on the economics of installing a 350 MW unit at Colstrip and shipping coal by rail to a location outside of Montana to provide the equivalent of 1050 MW (1400-350) of thermal generation.

Again, MAIN will compile and organize the information so as to effect maximum impact at the March 17 hearings.

This evaluation withdrawn on 2/10/75 By J.T.E.

This review to be completed by February 28.

(3) Summarize impact of transmission - RI, AN, EI, acreage actually removed from production, etc. Appropriate graphs and slides will be made for use at hearings. Report by Leo Finnegan on the impact of unit trains to be sent to George Nesgos. MAIN, (Charlotte), report on electrostatic induction tests on fluorescent tubes to be sent to John Evans. MAIN will update their estimate of cost per mile of transmission line based on material and labor data now on hand. Montana Power Company is using a figure of $152,200 per mile.

(d) Mr. Evans requested that the final DNR report be examined carefully and any pertinent comments sent to him that we felt were important, particularly comments on their recommendations for construction practices. He would especially like to be advised whether they have made a specific line route recommendation. If such a recommendation has been made, our comments pertaining to each section of the route would be necessary.

(e) It was agreed that we would secure pictures of existing guyed structures, clearly showing the use of the land under the structures for agricultural purposes, as well as pictures of self-supported towers where land under the center of the tower could not be used for agriculture. A comparison of the two types of structures would be made regarding the loss of land for agricultural purposes.

(f) MAIN agreed to examine the possible loss of land for agriculture due to building access roads and compare this with the DNR Report and Westinghouse Report.

2. Procurement

(a) Units 3 and 4 and therefore the 500 kV transmission lines have been postponed for one year. All materials for which we have orders or options to purchase for the 500 kV lines are to be rescheduled accordingly with no penalties or cancellation charges if possible. ALCOA and Lindsey are the two vendors which may want to collect penalties. All subcontracts to be reviewed for cancellation.

(b) Mr. Evans requested that MAIN inform their expediters that we would not accept any delays in shipment of materials beyond the dates promised. He specifically requested that any such matters be promptly attended to by our expediters.

(c) MAIN produced a bar chart indicating the present shipping dates promised by various suppliers. This was discussed by the group and it was agreed that such a chart should be updated and furnished twice each month. Later on the bar chart was modified to show the shipping date commitments given to JELCO at the Salt Lake City meeting dated December 12, 1974. Information was also shown on the chart, as obtained from John Cain, indicating the proposed construction schedule, broken down by: Anchor and Foundation Installation; Tower Erection; Conductor Stringing. It was agreed that this chart would be prepared in a similar format as that shown to the group, and updated as requested above.

(d) Mr. Evans indicated that he was very concerned about the specifications prepared by MAIN and stated that they could be reduced in size considerably by eliminating a lot of "boiler plate" and unnecessary verbiage.

(e) He requested that a new Cash Flow Chart be prepared and that this be updated every two weeks. Cash Flow Charts were requested for each part of the project, i.e., (1) 230 kV double circuit line, (2) Broadview 230 kV switchyard, (3) Broadview-Hot Springs 500 kV line, etc.

(f) Determine from suppliers if they have any labor negotiations coming which would affect deliveries.

3. Right-of-Way

(a) There was considerable discussion pertaining to the 150-ft. right-of-way width as related to the guy locations. Mr. Evans stated that their lawyers disagreed with the statements in Mr. Zobel's letter and, in fact, said that he was "practicing law." They insist that guys will fall within the R/W on all state lands and for all land acquisition involving condemnation. All exposed excavation must be within the R/W. We agreed that in some instances the guys would be moved within the R/W by changing the guy slope if this involved only a few feet. In other cases we would relocate towers, using shorter spans and therefore shorter towers, to accomplish the above. It was further stated by Mr. Evans that on all other lands, negotiations would be made with property owners for land for placement of guys beyond the R/W.

(b) With regard to changes in line route, and re-spotting of towers to bring guys within the R/W, it was understood that additional towers may be required. Following some discussion about possible delays in receiving these towers in time to fit the construction schedule, it was agreed that if American Bridge could not meet this schedule, additional sources of supply would be attempted.

(c) Mr. Evans indicated that the securing of right-of-way was moving very slowly and he was concerned about construction progress because of possible delays. He requested that Chet Taylor discuss these matters promptly with Universal Field Services and furnish an updated report on progress being made.

(d) A request was made for a cost comparison of guyed structures vs. self-supported structures. This information was furnished to those at the meeting who were interested in this information.

(e) Mr. Evans requested a description of the work being performed by Patrick Associates and by Universal Field Services.

4. Schedules and Status Reports

(a) MAIN was requested to prepare a new schedule for the project based on in-service dates for Units 3 and 4 of July 1, 1979 and July 1, 1980 respectively. It was agreed that one Colstrip to Hot Springs 500 kV line and conversion of the 230 kV double circuit line to 500 kV must be completed by the time Unit 3 is ready for start-up. A construction completion date of December 31, 1978, was suggested to allow adequate time for relay testing before start-up.

(b) MAIN was requested to submit charts of estimated and actual costs versus time for all major tasks as well as the total project to provide an early warning of possible overruns.

(c) A plot of percent completion of major tasks was requested also.

5. System Planning Studies and Design Engineering

(a) All system planning work is to be discontinued until further notice. The present on-going study on the transition phases should be completed and a report issued as soon as possible. The subsynchronous and TNA studies will be resumed if the outcome of the March 17 hearings is favorable.

(b) It was suggested that a design review meeting should be held at least once a month so the engineers from each of the participating companies could monitor more closely the work being done by MAIN. A tentative date of March 6 was set for the first meeting.

(c) Mr. Evans also requested that in the future any cost estimates furnished to him be given in considerably more detail.

(d) Mr. Evans requested that he be furnished with information on the final cost of the Anchor Test Program, broken down into Labor and Material, along with an explanation for the overrun of our original estimate of $99,000. He requested that this information be furnished within two weeks. MAIN advised that in furnishing this final cost of anchor testing, we would also advise of the final estimated savings accomplished through the test program, which was nearer 3 million dollars instead of the original estimate of 1 million dollars.

(e) Mr. Evans approved awarding a contract to Christian, Springs, Siebach Associates for surveying at Broadview Substation.

6. Miscellaneous

(a) Mr. Evans requested that meeting minutes be issued promptly.

(b) JELCO's invoices are to be signed by Ralph Brown and John Cain before being submitted to John Evans.

(c) A list of the inspectors to be used on this project is to be submitted to John Evans along with copies of their experience records.

(d) Mr. Zambotti reviewed the changes which have taken place, or will soon occur, in MAIN's organization.

(1) Mr. Greve resigned.

(2) Mr. Frank Hamilton, VP, takes his place as district manager in Portland.

(3) Mr. Merrill Harkness takes his place as manager of the power group and will backup Mr. Taylor on the Colstrip Project.

(4) Mr. Herb Stockwin, VP, will move to Charlotte, N.C. as district manager.

(5) Mr. Howard Barnes, formerly with AEP, will take over Mr. Stockwin's responsibilities in Boston.

(6) Mr. George Nesgos will move to Tehran, Iran in summer of 1975, to assume charge of MAIN's operations there.

(7) Mr. Robert E. Ender will replace Mr. Nesgos in the System Studies Department.

(8) Mr. David Stewart, VP, assumes charge over all the district offices.

IN THE DISTRICT COURT OF THE FIRST JUDICIAL DISTRICT

OF THE STATE OF MONTANA

IN AND FOR THE COUNTY OF LEWIS & CLARK

IN THE MATTER OF THE APPLICATION)
OF THE MONTANA POWER COMPANY,)
PUGET POWER AND LIGHT COMPANY,)
PORTLAND GENERAL ELECTRIC COMPANY,) CAUSE NO. 38892
THE WASHINGTON POWER COMPANY and)
PACIFIC POWER AND LIGHT COMPANY)
FOR A CERTIFICATE OF ENVIRONMENTAL)
COMPATIBILITY AND PUBLIC NEED.)

DEPOSITION OF EINAR GREVE

May 2, 1975

Tucson, Arizona

Bonley, Schlesinger, Profitt and DiCurti
OFFICIAL COURT REPORTERS
187 NORTH CHURCH AVENUE
TUCSON, ARIZONA
PHONE 623-7573

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* * *

IN THE DISTRICT COURT OF THE FIRST JUDICIAL DISTRICT
OF THE STATE OF MONTANA
IN AND FOR THE COUNTY OF LEWIS & CLARK

IN THE MATTER OF THE APPLICATION OF THE MONTANA POWER COMPANY, PUGET POWER AND LIGHT COMPANY, PORTLAND GENERAL ELECTRIC COMPANY, THE WASHINGTON POWER COMPANY and PACIFIC POWER AND LIGHT COMPANY FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED.) NO. 38892

APPEARANCES:

MESSRS. TOOZE, KERR, PETERSON, MARSHALL & SHENKER
By MR. ARDEN E. SHENKER
For the North Plain Resource Council and Department of Natural Resources

MESSRS. GRAYBILL, OSTREM, WARNER & CROTTY
By MR.LEO GRAYBILL, JR.
For Montana Department of Natural Resources and Conservation

MR. RONALD F. HOCH
For Tucson Gas & Electric Company

MR. JOHN WALKER ROSS
For the Montana Power Company

TESTIMONY OF EINAR GREVE, of the City of Tucson, State of Arizona, taken before me, the commissioner appointed pursuant to the attached commission issued out of the First Judicial District Court of Lewis & Clark County, State of Montana, at 111 South Church Avenue, in the City of Tucson, County of Pima, State of Arizona, on the 2nd day of May, 1975."

MR. GRAYBILL: This is the deposition of Mr. Einar Greve taken pursuant to a commission issued out of the First District Court of the State of Montana based on a subpoena of the Board of Natural Resources. The Commission was then forwarded to the State of Arizona, and upon application of the Superior Court of the State of Arizona, in and for the County of Pima, a subpoena was issued again in Arizona and a notice of taking the deposition was given, and Mr. Greve was served with a subpoena, and the time and place was set, and that's why we are taking the deposition.

I think that the record should show that the directions of the Court to the court reporter and the commission, which are rather specific and which we are following, I would like to simply ask you to do so, so the First District Court in Montana will be satisfied.

Other than that, I would explain to Mr. Greve that his testimony is being taken here with the understanding of my client, North Plain Resource Council and the Department of Natural

Resources, we do not intend to call you in the State of Montana to testify but that your deposition here is under oath and is admissible in the courts of Montana, and in the hearing before the Board of Natural Resources in Montana. And in view of the fact that you will not be called by us, we would feel free to use your deposition in that proceeding.

Do you have anything to add further?

MR. SHENKER: On behalf of the Department of Natural Resources in this proceedings, I can advise the witness it is not our intention to seek to have him personally come to Montana to testify, but the testimony he gives today may be introduced into evidence as if he were there instead.

I will also advise the witness that I am advised by the Northern Cheyenne Tribe, one of the other parties to the proceedings, they share the same intention as we do, not to ask the witness to come and testify in Montana.

And I should further state for the record, John, I suppose the same stipulations we have had in all of the other depositions taken in this proceedings, that none of the parties to this case raise any objection to the time, place or manner of the taking of this deposition and that the witness may sign the deposition after reading it before any Notary Public.

I think Roland may want to make some statement with regard to the jurisdiction, recognizing that he represents the deponent in this case.

MR. HOCH: Yes.

MR. GRAYBILL: You have something you would like to add at this point?

MR. HOCH: Yes. Briefly for the record, I would like to indicate Mr. Greve is responding to an Arizona Superior Court subpoena which was dated April 23rd and was served on him the 28th of April. He reserves, Mr. Greve reserves, contends he is not subject to the jurisdiction of the State of Montana, and reserves the right to contest any claim of such jurisdiction at any time in the future.

Mr. Greve is appearing today in response to the Arizona subpoena for purposes of answering, to the best of his knowledge and recollection, all relevant questions which are addressed to him in the hopes that the proceedings in Montana will not be further delayed. That is all I would say at this time for the record.

MR. GRAYBILL: John?

MR. ROSS: Nothing.

MR. GRAYBILL: All right. Mr. Greve, I will proceed to start the questioning.

EINAR GREVE,

you do solemnly swear that the evidence you shall give in this matter shall be the truth, the whole truth and nothing but the truth, so help you God.

EXAMINATION

BY MR. GRAYBILL:

Q State your name and address for the record.

A My name is Einar Greve, my address is 5051 North La Lomita, Tucson, Arizona.

Q And what is your employment?

A I am employed by Tucson Gas and Electric Company.

Q In what capacity?

A I am senior vice president of the company.

Q With what responsibilities?

A Responsible for resource planning and development.

Q How long have you been employed there?

A I have been employed there since the first part of February, 1975.

Q And where were you employed prior to that?

A Prior to that time, I was employed by C. T. Main Incorporated of Boston, Massachusetts.

Q What is your educational background, and primarily I am concerned with your, where you got your college degrees, and if there are post-graduate, or the nature of the degrees.

A I am an electrical engineer; I received my undergraduate education in Europe at the Technical Institute of Norway, and my Master's Degree from the Massachusetts Institute of Technology in Boston.

Q When?

A 1953, the latter.

Q And I wonder if you would trace for us your employment since you left college with your Master's Degree.

A I was employed by C. T. Main prior to entering the graduate school, and I was on leave of absence while I was in the graduate school. I have been employed by C. T. Main since 1952, from 1952 through 1964 with a few interruptions such as military service.

During this time, I have been responsible for various design sections of transmission and generation facilities. Later for several years I was responsible for a department that handled planning studies and overall development plans for power systems, and later still I was in charge of the Portland, Oregon office where the predominant work was design transmission substation facilities, some studies of power facilities were also conducted from that office.

Q When did you start in the Portland office?

A 1971. I started in the Portland office for Main in 1971 and essentially built it up to where it is today or where it was when I left it at the beginning of 1975.

Q In conjunction with your work in the Portland office, did you have occasion to become involved in what was known as the Colstrip Project for five Pacific-Northwest power companies?

A Yes. In January, 1973 Main was engaged as the engineer for the engineering and planning of the transmission facilities involved with the Colstrip project.

During the first two years of this work, 1973, 1974, I was the project manager for that effort.

Q Did you have responsibilities before Main was engaged in terms of making the application or bid that Main made? As I understand it, there were several engineering companies considered.

A Yes. The proposal at that time for four power companies involved in the fall of 1972.

Q So your responsibility from the point of view of C. T. Main was started when you first became aware of this project, it began to make plans to bid on it; is that correct?

A Well, my responsibilities with Main had been continuous. The project contractually started in January of 1973. In the course of 1972, I heard various plans being discussed, and in December of '72 prepared and presented a proposal to do some of this engineering work.

Q Can you tell me the date on which you left C. T. Main employment?

A I believe it was effective the last day of January.

Now, I hesitate from the point of view that I had certain amounts of vacation due, I wasn't actually working towards the end of January, but --

Q All right. Well, now, Mr. Greve, there was a meeting on February 6th and 7th, 1975 at which time the project was reviewed and examined in terms of the coming hearing before the Board of Natural Resources. I wondered if you are aware in the discussion at that time, the Montana Power Company said that they would like to have you testify for them.

Are you aware of that?

A No, I am not.

Q I don't want to admit that, but I would like to show it to you in the Minutes of the meeting.

A I did have a conversation with Mr. Evans.

Q That's Exhibit 13 in Mr. Zobel's deposition, and you have examined it and you note in those Minutes you were referred to as a possible witness?

A I note where it says that, yes, sir.

Q Were you aware of that circumstance?

A I did have a conversation with John

Evans of the Montana Power Company at approximately that time, and I advised him that I had no time and would not be available as a witness because of pressing involvement down here, and I felt there were other people who could give the same testimony that I could give.

Q Now, Mr. Greve, I want to show you a letter over your signature dated May 31, 1974 addressed to Mr. Evans, the project coordinator, and call your special attention to paragraph one there where it's marked.

A Okay. Yes, I remember these where a number of questions asked by the BLM, and I see what you are saying.

Q All right. Now, let's mark this for admission.

(Exhibit 1 marked for identification.)

Q (By Mr. Graybill): Now, Mr. Greve, you have referred, seen Exhibit 1 here, and it has a sentence here that it says "In the early mid-1980's, additional transformer capacity will be required for the system."

I would like you to explain that to me.

A Okay. I think I should, to make it perhaps clear to you how the work was conducted, explain how the various areas of responsibility had been divided. The work had been divided into three main efforts. The one was the electrical and systems studies which were conducted under Mr. Nesgos, N-e-s-g-o-s, and in the Boston office of Main.

The second effort was the transmission design and involving the structures, mechanical ?? strengths of conductors layout, the right-of-way, et cetera, which was under Mr. Zobel in the Charlotte office. And the third area of effort was the substation and communication facilities which were designed in Portland under Mr. Taylor, who also functioned as project engineer.

This particular statement in this letter which you are referring to was based on studies conducted by Mr. Nesgos's group, which indicated that to meet the load in Montana, additional capacities would be required at some point in time to provide for this load.

Q Well, was it to be additional capacity, you mean additional capacity had to be built or brought into service?

A Additional transformer capacity.

Q Did that have anything to do with additional power production?

A No.

Q So when you wrote that, it had no reference to any additional capacity?

A In generation.

Q In generation?

A No. What this -- what this referred to, you see, the transmission system as planned in effect has to function. One is to carry power across the State. The other is to integrate the new system with the existing power system in Montana.

The existing power system in Montana, and I'm sure you are aware, is relatively limited and whether you built the system or not, somewhere in the future, additional capacities are required to serve the load in Montana.

Taking advantage of the existing lines in Montana, we had identified one location at Broadview, one in the vicinity of Helena as being good feed-in points from the stepdown from the 500 kV, and from them serve loads in Montana as the loads would grow.

There are a number of other technical advantages in having these stations at this location, but this was addressing ourselves directly to the sentence. This was the primary reason for that.

Q Are you familiar with what was called the Colstrip Pacific Northwest Study?

A By that name, no.

Q Look at that document. This was a document gotten from the C. T. Main office in Portland. Do you recognize it or are you familiar with it?

A I don't recognize it offhand. I note it's on the date of 11-17-72, but I don't know what the origin of it is, and if I can read it through, I can probably tell you what it talks about.

Q Sure.

(Witness reading document.)

A This appears to be, and I would like to ask it as a question, this appears to be a preliminary study conducted by the utilities prior to assigning Main the assignment that we later received. Is that correct?

Q I think that is correct.

A It looks like some of the preliminary work that had been done. I knew there was something in their work, I didn't know we had a copy of this.

Q Calling your attention to subparagraph

B on the front page --

A Yes.

Q You have read that, that is marked?

A Yes, I noticed what it said, too.

Q Do you know what it means, what in your opinion does it mean?

A It appears at this time in trying to evaluate what should be studied, the companies had also looked at the possibility of future generating units beyond the four currently planned for the Colstrip.

Q What do you know about that? Had you heard about that before today?

A Yes. We have never made any study, Main never made any study with generation beyond the four units. In point of fact, the studies have been carried out and the particular -- let me think -- the particular characteristics of this electric system are such that it would be extremely difficult to add additional generation on this transmission system.

In my opinion, this transmission system has a practical limit of just what is hanging on it. To go beyond that, you would have to build additional lines or add some other facilities or develop a load near to generation because of the characteristics of the system.

Q Yes, I understand that, Mr. Greve. But my question is, have you heard about a potential Colstrip 5 and 6, for example?

A Have I heard?

Q Yes.

A Well, let me put it this way. Our assignment was to develop --

Q I understand your assignment. I just want you to answer honestly whether you heard about a potential Colstrip 5 and 6.

A Potential Colstrip 5 and 6, not in those words. The transmission system, we naturally look at what is the capability of the system, could you add, sometime hang additional generation on it.

Q I understand that. I am not asking you that question.

The letter refers to the possibility of additional generating capacity beyond Colstrip, one, two, three and four.

A Yes. I never seen this letter before.

Q I understand you haven't.

A I never heard --

Q I really think you do understand my question. My question is, I think you have indicated to me that you did have some knowledge of a possible generating facility beyond that.

A No, I specifically do not want you to interpret what I am saying that way. We looked at the transmission system with a question in our minds as to room for a fifth unit, but it was never part of the assignment.

Q I understand that.

A We never tried to put a fifth unit. In fact, it isn't possible, and in the design as it is.

Q Now, I want to make it clear, my question is not in the area in which you have answered. My question is: did you hear about a potential fifth and sixth units?

A I think the answer is no, I don't think I have heard of a potential fifth and sixth unit. We did examine the system to see what the limitations were.

Q I am not interested in your transmission system; I am interested in whether or not you or C. T. Main under your direction ever had any indication that there might be a fifth or sixth unit planned later on.

A I don't think so, I'm reasonably sure.

Q I want you to search your memory about that because --

A Yes.

Q -- I want you to be right in what you say, whether you have ever had any indication that a fifth and sixth unit might be involved later on, not in the transmission line, I am not trying to say it would be carried on your same transmission line. I want to know if there was any possible planning for that type of a further development ever mentioned to you.

MR. ROSS: Leo, it might help if you ask --

THE WITNESS: Somewhere along the way there was some talk by somebody, I can't identify it, about a coal-gasification plant in the Colstrip area. I don't remember who might have talked about it, but I think it was perhaps in the press or someplace.

Now, you see, since that load would not go over that line, you could conceivably add a unit to feed that load, but I think my answer to you has to be no, I don't believe I ever studied a fifth unit or anybody suggested there was going to be a fifth unit there.

Q (By Mr. Graybill): Do you know --

A As a matter of fact, I am surprised to see that letter, having a sixth and seventh unit.

Q What you are saying, although this came out of your files, you are unaware of it?

A As a matter of fact, I usually initial things that I read. I never seen that. What is "CF"?

MR. SHENKER: That was on the document after it was obtained.

Q (By Mr. Graybill): It referred to various facilities systems?

A No, I never seen that before.

Q What do you know about the corridor width on the transmission system that you were the project manager of? Do you know what it is?

A My recollection is three hundred feet.

Q Is that what it has always been?

A I am not a hundred percent sure, but that is what it's been since the, shall we say, line configuration was more or less finally determined.

Q When was that?

A Oh, probably mid-summer, '73. We may have looked at a narrower right-of-way earlier but it was decided that for reliability and various other reasons that the three hundred feet would be more comfortable.

Q Calling your attention to an inter-office memo to you from Mr. Zobel in March of '73, does that refresh your recollection as to what it originally was?

A Yes. We presently plan to use a right-of-way of two hundred fifty feet. Yes, it is more economical to use a three-hundred-foot right-of-way.

Q Showing you the same document, a paragraph about what was expected in terms of spans, can you tell me whether that is correct?

A That is what he says there, and I think we -- I think we are still approximately at the same span length.

Q And that is an average span of thirteen hundred feet with a range from eight hundred feet to twenty-five hundred feet; is that right?

A That sounds reasonable, certainly it doesn't vary considerably from that.

I should like --

Q I would appreciate it if you would just answer my questions, Mr. Greve.

A Okay, fine.

Q Showing you a letter dated -- inter-office memo from Mr. Nosgos to you dated June 7th, 1973, I call your attention to paragraph 1(b).

A Yes.

Q Is it your understanding that is still the situation with the transmission line or is there a difference? It discusses the amount of space between the outer phase and the edge of the right-of-way.

A Between the outer phase and the edge of the right-of-way?

Q Is that still sixty-five feet as it says there?

A I would have to sit down and figure that out. It is approximately that order of magnitude.

Q It is your judgment based on the three hundred or the two hundred fifty foot right-of-way?

A Well, whether -- it doesn't matter, the sixty-five foot applied to either one, but the three hundred foot right-of-way was a requirement that came up later on in the development of the conductor size.

I am sure Mr. Nesgos had later studies that would support that.

Q In other words, you are saying that the right-of-way width was a function of the conductor size rather than of the --

A The right-of-way width is the function of very many things. One of these things which changed was the conductor size which affects the size of -- which affects the swing to the sides.

Q In the same document which is Zobel's Exhibit Number 9, there is a reference on page three to the fact that the TVI and ozone has not been investigated; is that correct?

A Well, this was in June, 1973. Subsequently these things were definitely investigated.

Q So you have the TVI and ozone situation investigated?

A These things were calculated, as I recall, they were provided to the department in several pieces of correspondence.

Q What is your recollection about what was done according to the TVI which is the television interference issue?

A The detailed data on that was developed by Mr. Nesgos' group, I don't recall the numbers. I am sure that all of these were transmitted to the department in several letters that went on through answering questions from the department.

Q And what do you recall being done concerning investigation of the ozone problems?

A Well, if my memory serves me, it was a fairly well-known phenomenon, and we obtained empirical data from other and similar facilities. By calculation, as I recall it, there couldn't be determined to be trace elements available. These are all in information that Mr. Nesgos' group developed. I am sure we transmitted it to John Evans, who transmitted it to the department, because they raised these questions several times.

It must certainly be in the records somewhere.

MR. GRAYBILL: Will you mark that?

(Exhibit Number 2 was marked for identification.)

Q (By Mr. Graybill): I show you Exhibit Number 2, which is an interoffice memo from your office to Mr. Nesgos in April of 1974. The first paragraph, does that establish that the right-of-way is now to be three hundred feet, is that right?

A This does establish that the right-of-way was three hundred feet.

Q It does mention that. Is that an indication that is what you established, is that what --

A In my memo, I think the right-of-way was established earlier and that at this time, as I wrote it, the three hundred foot right-of-way apparently was established.

Q Was established?

A Yes.

Q Now, you talked in here about trying to get not closer than five hundred feet to any dwelling; is that correct?

A That was our intent in picking the right-of-way and -- yes.

Q Why was that?

A That's a good question. I think I would like to refer you to Gene Zobel on that point.

Q You don't have any opinion on that as an engineer?

A There is no problem being that close to a dwelling, but usually if you have to go in and do things like grounding metal parts and gutters and the preferred approach is to stay far enough away where you do not have any interference problem.

Q Why would you have to ground metal parts and gutters?

A Due to static induction from the transmission lines between the line and ground and the metal parts which might not be properly grounded. This is standard procedure in all fences, gutters, and similar structures.

Q And whose responsibility is it to ground the fences, in your opinion, if you know?

A Well, the power company would do this without question. In fact, I am quite sure it is in construction specs.

Q Now, I want to show you an interoffice memo from Mr. Nesgos to yourself dated June 28th, 1973. See if I understand it correctly.

Especially paragraph two.

A Do you have some questions?

Q Yes, it says in here that there would be an increase of twenty percent in corona loss for every five percent in operating voltage above five hundred kV.

Do I understand that if the operating voltage was five hundred fifty kV, there would be a forty percent increase in corona loss?

A That is the way I would read the sentence. I believe you will find somewhere in Mr. Nesgos' records a chart which shows this graphically, corona losses. As you go up in altitude, they increase gradually, there is a distinction in the curve where you get above three or four thousand feet, they increase rapidly.

When you get up in the rapid range of high altitudes that corona loss becomes significant.

Now, this was when, this was in June,

'73. Okay.

Q The letter also, the memo also mentions that a change in altitude from a thousand to six thousand feet increases the corona loss by thirty percent.

Now, I take it that those are cumulative, in your judgment.

A That is the total of thirty percent. As I recall these curves, they go up at a gradual slope, then there is a kneebend and it goes up at a more rapid slope.

Our concern with corona losses was of some importance in finding that most economical conductor size.

Q Yes, I understand, Mr. Greve. Just let me ask the questions. Okay?

MR. ROSS: If he wants to explain his answer, Leo, he can do that.

MR. GRAYBILL: I didn't have a question, I just wanted him to understand that I would like him --

MR. ROSS: I want him to understand that he can explain his answer, too.

Q (By Mr. Graybill): Now, Mr. Greve, this letter deals with that very subject on the second page; I want you to read the second to last paragraph there.

As I understand it, in the second to last paragraph, the formula is arrived at because of the difficulty of ascertaining the exact corona loss due to weather conditions, primarily, and a formula is arrived at that, assuming that assumes certain amounts of snowfall, certain amounts of rainfall in Montana, and I want to know if you have any opinion whose decision it was, who set up this formula, who arrived at the assumptions there.

A Okay. I think I should point out to you that at the time that this was written, certain assumptions apparently were in his mind with respect to the size of conductor and weather conditions which we didn't have information on, then which we did get information on later on. And that the formula indicated here was not in the final analysis used.

Now, there is a very great difference between corona losses in foul weather and fair weather.

Q Right.

A We have a subcontractor who conducted a weather study of the --

Q I understand that, Mr. Greve. I am

coming to that.

What I want to know, do you know whose decision this is? Is this Nesgos' or your decision or someone else's, which is referred to in this letter?

A Well, as I see it, it is recommending -- well, as I see it, it was his recommendation.

Q Mr. Nesgos's?

A At this time, however, it was not what was used in the elevation.

Q All right. You had a great deal of difficulty in arriving at the final conductor, is that correct?

A Yes, I -- that was a very difficult analysis.

Q What was the principal determinate in arriving at the size of conductor, in your opinion?

A The -- well, how shall I put it -- the principal determinate having met all the other requirements, was economics.

Q Was cost; is that right?

A Yes.

Q And one of the factors in developing costs was developing corona losses; is that correct?

A Yes, that's correct.

Q Because that amounts to a loss in projected electricity, isn't that right, transmitted electricity?

A Right.

Q And am I correct that at one time the decision was made that a conductor called Eagle was probably the best, but that it later proved to be too weak or not strong enough?

A That sounds right. I can't remember which one the Eagle is.

Q I will show you this memorandum that I am looking at; I realize that is not the final conductor, I just -- a preliminary question --

A Okay. The Eagle, I think the Eagle is the 556.

Q Right.

A That correct?

MR. SHENKER: Yes.

THE WITNESS: Okay. Well, now, there are a large number of standard conductors being manufactured, and to meet the various requirements like radio, TV interference and everything that we needed from the electrical analysis, we needed a certain minimized size conductor, whether a bundle of three or four or even two was considered. Some of the conductors which would meet all of the requirements and the standard manufacturing mode would not have adequate strength.

However, it might be possible to manufacture a similar conductor by replacing the steel core with a high strength steel core, and this was one of the reasons why we had such a difficult time trying to determine which conductor to use.

The Eagle in the standard configuration we concluded was not the most economical conductor because it lacked strength.

Q Well, in this memorandum of July 20th, 1973, which happens to be Zobel's Exhibit 18, on the last page over your signature, you conclude that Eagle is a good conductor, but you would like to have it made with a stronger core; isn't that correct?

A That's correct.

Q And isn't that finally what happened?

A Well, no. Here is what happened. This was in the summer of 1973 and everything that looked good in the spring of '73 all of a sudden started to change.

Raw materials began to be in short supply. We had two ways that we could go. One would be to replace the aluminum stands with alloy and another would be to get a high-strength steel core.

We talked to manufacturers in the summer of '73 and the various manufacturers would follow one route or the other. But in the fall of '73, all of a sudden I couldn't get high-strength steel strands and the alloy costs went up through the ceiling in price, and when we finally went out for bids, we didn't get responsive bids on special-type conductors.

We did get responsive bids on the normal conductors, but that was not strong enough. We had to go through the whole process over again, limiting ourselves to normal conductors and in the end we ended up with a seven ninety-five, which is a good deal larger, but has the required strength.

Q The so-called mallard conductor?

A Yes. That is the one that finally was accepted. I should say one other thing. The cost of money was skyrocketing through '73, and the early economics and analyses which we had made were questioned by at least one of the participants, that was P.P.&L., they had awoken to the fact that the cost of money was going to go up, and that affected the evaluation of conductors.

So we ended up with a mallard finally, which is a much larger conductor in diameter than what was necessary to meet the electrical requirements.

Q Let me ask you, explain the difference between the two and three and four bundles.

A All right. The principal reason we use a bundle conductor is that electricity, it appears as though you have a conductor with a diameter equal to the bundle, for an example, if you have two conductors eighteen inches apart, electrically they appear as though you drew an ellipse around them.

Three bundle electrically appears as though you do more or less a circle around them. With a four bundle, you get that much bigger circle.

What this does to you is that it reduces the impedance of the line significantly and thereby electrically shortens the distance between the sending and receiving ends.

It also does all the other things like reducing corona losses significantly. It reduces radio and TV interference significantly, and what we thought we were limiting the conditions in this coming one. A five fifty-six conductor obviously will meet that much better when we have a larger conductor.

Q Five fifty-six refers to what?

A Five fifty-six is the cross-section, it's the five hundred and fifty-six thousandth circular miles of a cross-section in an aluminum carrying area. The one we have now is in seven ninety-five thousandths. The difference in diameter is, maybe, oh, one or two-tenths of an inch, but it is very significant in the effect that it has on the radio and TV interference and so forth.

Q Yes. I think the new one is 1.4 inches; isn't that right?

A I don't think it's quite that big. But --

Q I looked it up last night.

A You may be ahead of me on that point.

Q Okay. And so what you really did was go to a larger conductor because that was the only way you could get strength mechanically?

A The mechanical strength, and at the same time it was more economical because the cost of losses that increased in the course of the evaluation.

Q In other words, you had less corona

loss on the larger --

A Oh, definitely.

Q For an example --

A I think you will find in George Nesgos's memos later in the fall of '73 there is some detailed calculations on the corona losses.

Q Are there any disadvantages of going to a bigger conductor, larger conductor?

A Costs more money.

Q Because you are buying more pounds.

A Sure.

Q Any other disadvantages?

A None that I can think of.

(Exhibit 3 was marked for identification.)

Q (By Mr. Graybill): Examine that particular document with the marked paragraph.

MR. ROSS: September 20, '73?

THE WITNESS: Yes.

Q (By Mr. Graybill): All right. This is a memo from Nesgos to yourself dated September 20th, 1973. I would like you to explain the third paragraph to me.

A The third paragraph reads, "The levelized mill rate for Colstrip energy, assuming fuel escalation, is 3.3 mills at the Colstrip bus.

Assuming four percent losses, value at Hot Springs would be about 3.5 mills."

Q What does that mean?

A Are you referring to what it means to levelize fuel costs?

Q What does the 3.5 refer to and the 3.3?

A The cost of the incremental cost of energy, the generating station and the receiving ends.

Q And that cost is computed in terms of total cost to produce that electricity at that point?

A Not the total costs. This is essentially the fuel and variable maintenance cost portions of the energy. When you deliver a kilowatt, you have to have a certain capacity behind it, whether you deliver it for one day or ten days, that is a fixed cost. But the cost of energy, burning up coal.

Q In other words, that is a non-fixed cost?

A The non-fixed cost, the variable cost.

Q The operating costs in a sense?

A Yes. And includes both the fuel and those operating costs which are variable. Some operating costs are said to be fixed because you have to have them whether you are running the plant one hour or eight thousand hours.

The source of that information, I believe, was the power company.

Q I want to show you a letter from yourself to Mr. Evans dated February 22, 1974, want to call your particular attention to this paragraph of the Alkali and Anaconda bids.

A Yes, I see the paragraph.

Q And this is another letter to you, and showing you, I just want to point out, apparently there is eight million six hundred thousand pounds of conductors that would be brought in the first group; is that the first phase?

A Eight million six hundred thousand pounds is for the transmission that went between units one and two.

Q Do I understand this letter to say that, this first letter to say that there is only six-hundredths of a cent difference between the Anaconda and Alkali bids on that first, at that first time?

A Yes, that is correct. The major differences between the bid was the delivery in subsequent years.

Q In the initial period, there was a very minor difference?

A That's right. What was to be delivered, I guess in '65, was virtually the same; but the future years' quotations varied by several cents.

Q Now, you have mentioned, Mr. Greve, the fact that there was some meteorological evidence gathered. I take it that you are aware, or maybe you did the negotiating with Meteorology Research, Inc., is that correct?

A Yes, I think that is correct.

Q Apparently, originally there was a request that this -- let me ask you, let me show you a memorandum from Mr. Zobel to yourself, or a letter dated June 22nd, 1973, and I call your attention to what I have bracketed there.

A Yes, I see what you have in the letter.

Q Do you know why a request was made for a twenty-five-year return period?

A And the fifty-year return period?

Q Yes.

A The meteorology data available in Montana was very scanty, and Meteorology Research made projections of fifty-year storms based on the data that they had been able to collect.

Because of the fact that there was some little data available, the uncertainty for the extreme conditions is very great. Do you understand that?

Q Uncertainties?

A The uncertainty as to the probability of storms in a fifty-year period, the worst that can happen in fifty years is very great. We wanted to know what is the sensitivity of this uncertainty; is it -- if you look and say only a twenty-five year probability, how much difference is there?

Maybe there is no difference; maybe there is a significant difference.

Q What was the difference in your recollection?

A I don't recall that there was a significant difference. It seems to me we have designed for something like a hundred-mile-per-hour wind along one stretch of the line, and one hundred and twenty miles along the other stretch.

To be sure that you have the right answer to that question, I think you should ask Mr. Zobel how he concluded that in the setting of the criteria for the structural design.

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(Exhibit Number 4 was marked for

identification.)

Q (By Mr. Graybill): Showing you a letter that was marked 4, showing you Exhibit 4, which is Mr. Zobel's letter to you, and it contains, as he says, "Attached is a draft of a design memorandum," and the design memorandum is here, and calling your attention to the second paragraph, I think he there explains the difference between the differences in quantity between the twenty-five and fifty-year return period request.

A Yes.

Q It had a tendency to lower the amount of radial ice to be expected and the amount of wind to be expected; isn't that correct?

A It had a tendency to lower the amount of ice at those particular wind levels, which would be expected, yes. This was a tough thing to get a handle on.

How much ice do you really have when it's windy?

Q I would like to call your attention to this other paragraph that I have marked here and see if you recall if you can -- did you know this fact or were you aware of this fact when you made decisions about the power and conductor systems?

A Yes, I'm quite sure.

Q And the fact that it says here that, this design memorandum says that the wind velocities were fairly reliable but the data on the ice accumulation is largely statistical, isn't that right?

A Yes. Ice accumulations are very hard to get a handle on at specific locations.

Q Is it true that the design of your towers was affected by the meteorological evidence you got?

A Yes. We got the meteorological studies in order to economize the design, make it as economical as possible.

Q Can you tell us the limits that you established as necessary to be safe in the tower design in terms of ice and wind?

A Well, I believe, I don't remember offhand, I believe the numbers you have here are the ones that were used.

Q The ones in the design memorandum?

A Well, let me say this: this is a design memorandum dated June 22, 1973. That was before we came up with a final conductor size. It may have been changed, I don't recall. I don't recall whether these are the final numbers or not.

Q Well, you understand that this memorandum does say that the towers were designed to carry two inches of radial ice; right?

A Yes.

Q I can tell you that Mr. Zobel has already testified to that.

A I don't question that, but the question was what winds do we have two inches of ice?

Q Right. There is some classification of higher winds and --

A Different ice loads and different wind loads.

Q What you are saying, you don't know whether these are the right ones or not?

A That's correct. As I say, they have been modified, and I am inclined to think that they were modified, but I can't recall whether this was the last decision or whether there was another one.

Q But you are aware, are you not, that this information from the meteorologist requires that you change your loads significantly on the towers?

A I would put it this way: no, I wouldn't call it significantly. We adjusted the load assumptions based on the meteorological studies.

Q So you would differ with Mr. Zobel, who in the memorandum dated July 11th, 1973 from himself to Mr. Nesgos, did call it significant?

A Well, I think this is a matter of judgment, what we call significant or -- let me put it this way:

The change in the numbers was not very large; it may make a different change in the tower steel design.

Q Do you recall that the two inches of radial ice was a limiting factor or important factor, at least, in your tower design?

A I believe that is correct.

Q And the towers were, is it not true, designed so that they could carry two inches of radial ice weight; isn't that the idea?

A Yes, that's correct, provided that is the right number. I am reasonably sure that is the right number.

Q The two inches is the right number.

A Okay.

Q Now, would the conductor system, talking about the larger conductors against the smaller, make any difference in terms of carrying two inches of radial ice? Would the larger conductor have to carry more weight in order to --

A By -- yes and no. Yes, the larger conductor, number one, weighs more. Number two, it has a larger radius to begin with and we are adding two inches radial to a larger radius. But the larger conductor has much greater strength and so it could carry this weight.

Q The design memorandum, which we just referred to, Exhibit 4, was sent to you on June 22, 1973?

A Yes.

Q Do you recall Mr. Wolfe, of C. T. Main, I think it's the Boston office; is that correct?

A He is in the Charlotte office, he works for Mr. Zobel.

Q Do you recall him explaining that there has been some experience in the Montana area where the ice was considerably heavier than the -- considerably thicker than two inches?

A Yes, I'm quite sure that is the case.

Q For an example, here on June 28th there is a memorandum from Mr. Wolfe to the file I would like you to be aware of --

A Yes, I think I remember this memorandum, the Bureau of Reclamation lost several lines up in that area.

Q And what does Mr. Wolfe's memorandum show you concerning the thickness of the ice?

A "Ice was observed to be six inches in diameter with high winds accompanying."

Q What effect, if any, did this memorandum have on you, and you are on the distribution list.

A Yes.

Q In fact, you are checked on the distribution list on this copy.

A I remember this memo.

Q What effect did that have on your plans for the towers and --

A We subsequently, as I recall it, obtained more detailed information on these particular line inches and you should be aware that when we designed for two inches of ice, we are talking, let's say, of solid ice.

There are many kinds of ice with different densities and the larger build-ups usually are what I call rime ice, or something like that, which has a much lesser weight per pound or per cubic inch. But because it has a large area to be caught by the winds in the event that the lines that were done were designed for a half-inch ice and wouldn't really --

Q They went down under six inches of ice?

A They went down under high winds, what appears to be mentioned. This ice is measured, you know.

Q But it isn't too difficult to determine the difference between six inches and two inches, is it, for an engineer?

A Not too difficult, I would say if you had six inches of ice and sixty miles per hour winds, most lines would go down.

Q Can you say, as an engineer, a line design to carry two inches of ice would not have gone down under the load that is described in this memorandum?

A The load described in that memorandum are not that precise. I can say that the line design for two inches would not stand six inches with sixty-miles-per-hour winds.

Q And so what really happened here, you went ahead and designed for two inches despite the fact that you were aware that seventeen miles north of Yellow Tail Dam, which is quite close to the area where Colstrip starts, that the Bureau of Reclamation lost eleven towers in the storm described here in April of 1973?

A Yes.

MR. GRAYBILL: Okay. Do you want to mark that one as --

(Exhibit Number 5 was marked for identification.)

THE WITNESS: As I mentioned, the Bureau's lines was designed for a half-inch ice. It might be of interest for you to know that they subsequently rebuilt it under the same design criteria that they had before.

Q (By Mr. Graybill): Well, you are not trying to tell me that because the Bureau might make a mistake that C. T. Main should make another one?

A I wouldn't call it a mistake. You can't say the design was inaccurate, for an example; you can always think of something that would bring down the line.

You have to draw the lines at the point which is reasonable.

Q Well, you should, then, in an area where there are ice storms, you should design for ice storms, shouldn't you?

A Only if they occur frequently enough and large enough, yes.

We have designed for ice storms, what we think is a load great enough with a frequency often enough to justify the amount of steel that is in these towers.

Q I understand it is a matter of discretion, but we are testing your discretion here, aren't we, Mr. Greve?

A I am not sure whether you are or not. I am not the structural engineer for this project.

Q I am testing your analysis. You are the project manager of the --

A Project manager doesn't make engineer's decisions in the area where he is not competent. But I happen to agree with the decision made by others on this project.

Q And what you are saying, then, is that although there was evidence of a major ice storm in the design here which took down eleven towers --

A Yes.

Q -- you nevertheless continued to design for ice loads less than appeared to have been the case in that storm?

A Again, the data from this particular storm was not that precise.

Q But the only data we find in your files is six inches. You don't argue with that, do you?

A The only storms they had that year.

Q The only line you were building, too.

Now, one day later on June 29th, 1973, Mr. Wolfe placed in the file another memorandum with you on the distribution list. Are you familiar with this memorandum which discusses an ice storm on the Jim Bridger line in Wyoming?

A It gives the design data for the Jim Bridger lines.

Q And they are higher than yours?

A Yes, they are. They are also designed from aluminum members and -- well --

Q I am particularly interested in the sentence that says, "That the lines go over a ridge eight thousand feet elevation where heavy ice and wind loads are expected."

A Right.

Q Are you aware from your meteorological data that wind and ice loads are to be expected on high passes?

A I believe that is reasonable. There are actually other places that may be worse, but you can certainly expect the funneling over high passes.

Q One reason for that is that wind has a function in making the ice form; isn't that right?

A Well, the moisture in the wind being pressed up over the higher elevations has a tendency to condense and fall out on the line.

Q But you apparently, from what you just said, agree with me that many times the most severe ice storms occur down in the lower areas in the wet storms; isn't that true?

A Yes, I think your wet storms are in the lower areas, but you are usually -- okay, yes, I think your wet storms are in the lower areas. Then again right at the continental divide, you can get wet moist air from the southwest pressed up high and even get it at high elevations.

Q You and I could agree that you are liable to have an ice storm both on the high part and low part of the lines?

A I agree.

Q And I take it you are familiar with the Wisconsin storm, that wasn't in any mountain pass?

A I am not familiar, but I have heard of it.

Q Were you made familiar at any time during the course of this planning effort that ice storms are not an uncommon phenomenon in the, what you might call the plains area?

A Around the Broadview area, I think it is rather common, in fact about this time of year, March and April, yes.

Q So that knowledge was --

A Available.

Q Available?

** (Exhibits 6 was marked for identification.)

Q (By Mr. Graybill): Did you want to make a comment?

A Yes. We have discussed the various loadings for which you design the structure towers, that doesn't say anything about the safety factors that you build in the design of the tower. You can design for a tremendous loading and have no protection in, say, surplus capacity or strength in the steel or in the conductor.

The towers for this particular line, these particular lines in Montana were subjected to extensive tests, not many towers are run through tests like that, and they were actually pulled apart until they failed before the design was finalized. That allows us to, with more certainty, know just how strong the towers are.

Q As a matter of fact, there was an

unusually large number of power failures in the tests, isn't that true?

A Yes, there were.

Q Do you have any explanation for that?

A No, I don't have a good one. The towers failed and we didn't allow the manufacturing to proceed until we had all of those problems resolved.

Q Do you have any opinion as to why the towers failed in the first place?

A Mr. Zobel is by far the expert on structural steel. I can only quote from what he has told me, but I think you could get it from him much better.

Q What is your recollection from what he told you?

A My recollection is that the computer programs which calculate the stresses in all the tower members, assuming that those members are all in one plane so that as to the stresses displaced themselves through the various members, it's directly in the direction pressure compression or tension in the direction of the members, in actual fact the members are bolted together side by side, you get a certain eccentricity in the application of these forces, which the tower designer can only cover by allowing himself a safety factor.

This was all done in the design, and nevertheless the towers failed and so they had to modify many of the connections and the size of the members and the bolting details in order to meet the required strengths.

Q The plan, however, is to make them as light as possible and still be safe, isn't that right, because you are buying steel?

A As economical as possible and still be safe. Sometimes you can pay a little more for steel and gain a little less, but I think that, to say --

Q Now, would you describe for the record the meteorology program that you carried out before you designed the towers in conjunction with the line or with the conductors?

A Well, for the best details on that, I think perhaps you should look at the specification and the reports prepared by Meteorology Research. Basically we desired to know the weather conditions along the preferred line as recommended by the Westinghouse Environmental Report, and for this purpose six weather stations were involved.

At two locations, we installed test

spans to try to measure ice build-up in these areas, and get a correlation with weather data that was available from some of the airports in the vicinity, not necessarily nearby, but as nearby as possible, and see if we, by correlation, could then project the data along the line route.

Q Do you have any idea why ice tests were not made at any site east of the Continental Divide in Montana?

A Well, first of all at that time, when this went in we had to proceed with the design of the eastern end of the line without the benefit of the weather data. We had a limited amount of funds available for the weather study and we concentrated the weather measurements as at those locations where we had the least data available.

There was some data available which we used for the Broadview area, around Broadview and so forth.

Q There was no icing test made, though, at site one, which was near Broadview, was there?

A No.

Q And there was none made at site --

A As I recall, we only had two spans, these were at locations where it appeared that you might expect icing conditions, but no knowledge of that area was available, no measurements or data from that area was available.

Q Site three was the highest site and you didn't take any icing tests there, did you?

A I don't recall what site was numbered which. I seem to -- really, I am not sure exactly where we had these.

Q All right. How many winters did you gather meteorology information with this set of sites?

A One complete winter.

Q And I am holding a letter here addressed to you from the Meteorology Research Project Manager suggesting that you collect information for two winters.

A Yes.

Q Do you recall that?

A Yes, I recall that.

Q In other words, you only collected it for one winter, is that right?

A Yes, that's correct.

Q Do you recall that they asked to have the meteorology evidence gathered the second winter in a long letter to you after the first winter?

A I don't recall the long letter, but yes, I remember it. We discussed the collecting of additional meteorological data.

Q He said that he felt quite strongly that sites one through four should be studied the next year. Do you recall that idea?

A Not specifically, but I hear what you are saying and I have no disagreement with it.

Q Nevertheless, the designs went forward without collecting the meteorological data the second year; is that right?

A The instrumentation that went in the first year became the property of Montana Power Company, and it was my understanding that, from John Evans, that he was considering utilizing the instrumentation, but monitoring it with his own people.

We had some discussions with Meteorology Research to have them instruct Montana Power Company's people in how to obtain this information, and as I recall it, they pulled in the instrumentation to overhaul it. I don't remember whether they got off the ground on this or not because, as you recall -- let me see -- this was at least one of the sites we had to move the equipment off there, there was an Indian reservation, they wouldn't let us keep it there. And another site was vandalized, although I think we salvaged the equipment, so I don't recall what his action was on this.

But I do recall that he intended -- he has the equipment and intended to make some use of it.

Q Did you ever get any information from the Montana Power Company for the second winter?

A No, no additional information would be available in time to proceed with the design. If we were to proceed on the schedule that we were on, the best we could get out of that information would be to, in some last moment if we found something, you know, very surprising, we could place some towers closer together. But that would be a last moment change and it wouldn't change the overall design.

Q Are you aware of the fact that meteorology people point out to you that the winter they took the test was what they call a normal or average winter and not a bad winter?

A It was not a bad winter, yes, I am aware of that.

Q In effect, then, you have no information from what you might call a bad winter from any of these particular sites; is that right?

A No, that is not right. We had several

years of records from various governmental weather stations around in Montana. What the Meteorology Research Data would give us would be a correlation between, weather along the route, say, with weather at Great Falls, Butte, and other airports where they have weather stations.

If you have several years of records at locations nearby but not directly where you are, then one year's observation will give you a correlation with how it was here, where it is very -- how it was there, and you can make projections from that. I don't deny that it would be better to have two years, but it wouldn't change the picture necessarily very much.

Q Now, Mr. Greve, I don't want to be argumentative with you, but my question specifically included the point that you had no other information from the six sites, and you ignored that.

A That's correct, from the six sites we have no other information.

Q So your answer referred to information you might have had from general weather data in the cities which are not immediately on the line, right?

A That is correct.

Q So understanding now that my question

was about the six sites, you do agree with me that you had only one year and a very normal and not a very bad year; is that correct?

A That's correct. I should point out that these are continuous records through the years that is not, you know, not just points --

Q Seven months, isn't that right?

A Yes, all through the winter.

Q And I take it you are familiar with this point?

A I am sure I read it; I don't know if I remember everything in it.

Q The second paragraph of the report here says "It was suspect that portions of the line might be subject to heavy ice and wind loads."

Do you see that? So you are really aware that there are icing problems to that line, isn't that correct?

A I think we are aware that there is icing conditions along the line, yes.

Q Yet you only took icing samples of two of the six sites, isn't that true?

A What we were installing at two of the six sites were test spans to determine the build-up of ice so that we could compare that build-up of ice elsewhere.

Q Are you aware that one of those test spans was either knocked down or vandalized or in some way inoperative for a couple of months during that winter?

A I think one month where we had some problem, I didn't know whether that involved the test span or not.

Q But you do agree with me that you went ahead and used the data from one normal winter in the face of recommendations from your meteorologists that you have two winters' experience, is that correct?

A Yes. We went ahead using the meteorological data that we had from one year correlated with other data, and based the line design on that.

I might point out that many lines are designed without the benefit of meteorological studies.

Q How many five hundred kV lines are there now in existence over the mountains in Montana?

A Only one to my knowledge.

Q Where is it?

A That's in the northwestern Montana extending into Washington, and I think there is a second one under construction or at least planned. I don't think it has been built yet.

Q Was this first one in operation long enough to be observed in a manner so you used the information from its experience and on this project?

A We used all of the available information on five hundred kV transmission lines. I don't personally recall any specific information from this particular line.

Q Do you recall any specific information from the Southern California Edison Company line over --

A Over the Tehachapi Mountains?

Q And Averde Saddle, which is the subject of this conference paper that you are now looking at.

A I don't recall. I don't recall having seen this paper before. I happen to be aware of the experience on this particular line, but I don't recall that it had anything to do with this project, that is previous experience.

Q And this is experience in 1970 in a California five hundred kV line that went over a pass five hundred feet -- five thousand feet high?

A That's correct.

Q And you don't recall whether or not you used the experience of the California, Southern California Edison Company in your design?

A I was well-acquainted with that particular problem they had down there. No, I don't recall whether we used that experience in any way except as it related to experience on five hundred kV designs in general.

Q They had a number of problems there.

A They sure did.

Q They had no sooner gotten it built in 1965 and it was knocked down by high winds, two towers collapsed in December of '66.

A That's correct.

Q And so they had to redesign to withstand certain high winds?

A Yes.

Q They did this by adding extra towers and shortening up the spans a great deal?

A That's correct.

Q And they shortened up the spans, put in one span for every four spans; in other words, they put in five?

A This was an average. There was places they had to go in between every second tower.

Q Now, have you done this in spots on your power line where it is likely to have high winds and icing?

A I think you should ask Mr. Zobel that. But there are locations where the towers are slightly closer together.

I should like to point out to you, if you are referring to that particular experience in Southern California Edison, that the line wasn't designed at all for any snow load.

On top of that, it wasn't designed for a conductor failing. On top of that, they got insulators which had material errors in them in manufacture, in fabrication, whether it says so or not on that paper, I happen to have this information from other sources.

Q Well, but would you agree with me that that line ran into considerable difficulties?

A Yes. But if it had been designed properly, it should have been able to stand up.

Q That is why I am trying to prove, whether you have a design that this one is proper, of course you think you have, but I am merely asking you.

A Let me say this: I happen to know all of the problems they had on that line, and I am sure that we at least learned from them not to repeat that experience.

Q What are the problems they had on that line?

A Well, you get into a number of design failures here, but number one, there was a two-bundle conductor, and the insulator dead-end was a string of two insulators.

It was not designed for ice and snow. The designers were not aware that there was ice and snow in the Tehachapi Mountains. The insulators had manufacturing errors in them, the portion that insulates between the outer parts and inner parts of an insulator is under compression. But in order to make the pressure even, there is an asphalt lining around the anchor or the ball of the insulator.

This asphalt lining had somehow been omitted in the manufacturing process so that you got uneven pressure inside the insulators.

The insulator strength broke under the expected loading, the line was not designed for strain to break and accordingly it was twisted into torsions and the towers fell down.

Q And they got a condition known as galloping or oscillation of the conductors?

A Galloping of the conductors, yes.

Q What kind of spacers do you have designed into the Colstrip?

A For the four conductor bundles, I don't believe they have been bought yet, but the intention is to use spacer dampers. I think Mr. Zobel could give you the best information on this.

Spacer dampers of that kind hadn't even been thought of, I think, when that Southern California Edison line went down.

Q That is not so because this report says during 1967 and January, 1968 many close string spacers and stock-type ground dampers -- one of the lessons that this report on the Southern California Edison Company says is important is you have to have meteorological analyses of proposed VH routes. You would agree?

A I think that is a good idea.

Q In fact, you had one year meteorological studies?

A Yes, I think we did.

Q The only trouble with it, it didn't extend for as long as the meteorologists thought it should, isn't that true?

A Yes, I think that's true.

Q Now, we will have a lot of other questions; I want to let Mr. Shenker inquire, but I want to ask you about, if you know anything about a formula from Ontario Hydro Commission, as I understand it, that C. T. Main used in analyzing corona losses on the final mallard conductors.

A I am not familiar with that.

Q You have never heard of that?

A I know that we have had substantial contact with Ontario Hydro and frequently exchange information. George Nesgos used to work for Ontario Hydro before he came to Main, and they have built five hundred kV lines with four bundle conductors, which nobody has in this country so far, I'm sure that we could have gotten informatio from them that might be useful. But I am not familiar with that.

Q All right, I'm going to let you go ahead. I have others. Go ahead. We will cover some of them.

EXAMINATION

BY MR. SHENKER:

Q Mr. Greve, I am Arden Shenker, I represent the Department of Natural Resources for the hearing. The questions put to you by Mr. Graybill during the deposition after its commencement this morning should be answered, should have been answered the same as the questions that I am about to put to you.

You understand that you are still under oath?

A Sure.

Q You understand the questions put to you should be answered the same as if you were in a court of law today; okay?

A No question about that, that's true.

Q If you do have any questions about the meaning of what I am asking you, by all means feel free to confer with your own personal lawyer, Mr. Hoch or Mr. Ross so we are sure we are communicating; all right?

A Yes.

Q Because the testimony that we obtain today may be used for perpetuation to be put into the proceedings itself.

A Yes.

Q Let me ask you a few questions first, Mr. Greve, on some of the matters that Mr. Graybill inquired into with you.

You told him that you have been

engaged here at the Tucson Gas and Electric Company since February of this year in the field of resource planning and development.

Do I understand that to refer to such matters as load forecasting?

A No. Actually the load forecasting is carried out by the operating department here. I have a function of reviewing it and developing plans for the future of the system to meet the forecasts.

Q Someone else does the forecasting essentially; you review that and make sure that the facilities will be available to meet the forecasts?

A That's correct.

Q And in your experience with the C. T. Main Company over the years, you also had to concern yourself from time to time, did you not, with the general approach towards proper load forecasting?

A Yes, I have been involved in this several times.

Q When you came to the C. T. Main Company in Portland in order to build up that office, you were first used in effect on what was a joint venture with Stevens, Thomas and Runyon, were you not?

A Yes, Main had a joint venture with STR and it was set up on the basis that Main was going to set up an office in Portland, we would provide the expertise but use STR drafting and design personnel.

Q Who was your main contact with the STR people for that function of drafting and design?

A Oh, I guess the main contact was the president, Mr. Thompson.

Q Was Mr. Miggs --

A Miggs.

Q -- one of the contacts also?

A Miggs was -- he was part of STR, I don't recall that he had much to do with it.

Q All right. Now, you told us that you knew of the Colstrip job sometime in 1972, and you became interested in obtaining that business on behalf of C. T. Main?

A Yes.

Q What did you do in order to obtain that business?

A Well, I visited Montana Power Company from time to time, I also at that time was doing work for other companies that became part of the four original companies involved in the project. I do believe that in 1972, at some time, that I made a proposition on a two thirty kV substation which at that time was contemplated by, which later it was decided not to build, oh, and we also made an environmental impact report, a very limited one, on the Billings-Great Falls two thirty kV line.

Q Now, the two hundred thirty kV substation and environmental assessment both were for the Montana Power Company?

A Yes.

Q Which were the other companies for whom you had done some work or made some proposals prior to working on the Colstrip project?

A Well, Portland General Electric was a client very early when we set up shop in Portland, I did some work for Southern California Edison Company, we had been doing work for Tucson Gas and Electric Company as a consultant prior to my coming here, prior to the Colstrip project. I don't believe I did anything for the Butte and Washington Water Power, and we have had -- done some work for PPL, but my timing on that -- I am not sure, I think that was also after we got started on the Colstrip project.

Q The environmental statement that you made for Montana Power Company in connection with the Billings-Great Falls lines, was that something you did for the client as an in-house kind of study or a formal document that was filed?

A It was a, I would call it a report for the client, evaluating the impact on the line. I don't know whether it was a formal document filed or not.

But our report was to the client.

Q Was it done in-house at C. T. Main or did you subcontract it?

A It was done in-house at C. T. Main at that time in our Boston office. We didn't have any staff in Portland that handled that type of work.

Q Did anyone from C. T. Main appear on behalf of the proposed line at any regulatory proceedings?

A I don't recall. I don't think so. The project manager for that job was Frank Brown. I do know he was in Montana several times. I do not recall if there were any regulatory proceedings involved.

Q The 230 kV substation was proposed for what site?

A The vicinity of Billings.

Q And do you know in connection with what generating facilities that substation was proposed?

A Yes. I think Colstrip one and two.

Q But you say that that proposal died because they decided not to go that route?

A That's correct. Let me put it this way: I think that is the reason. It could have been other reasons, I mean, they might have picked somebody else.

Q As far as your understanding is concerned?

A Yes.

Q What work had you done for PGE?

A A number of substations, we made evaluations of alternatives for nuclear sites along the Coast of Oregon, we did a service center where the main consideration was the architectural arrangement of the center to make it functional, and in the area of the power company's operations. Those are the main things, I think.

Q For Southern Cal Edison, what had you done?

A We made a -- let me put it this way: we participated in a site evaluation study for nuclear plants, combined cycle plants and a conventional fossil fire plant and a planning study for a county in Southern Cal Edison, these were all different jobs, not very large jobs, basically.

Q Was it in connection with one of those jobs that you gained the information that made you very well acquainted with the problems over the Tehachapi Mountains?

A No. I happen to know an individual who worked for the contractor who had to fix up the problems.

Q Who was the contractor?

A I think it was Schulman. I am not sure.

Q Who was the individual?

A Now, you shouldn't ask me that. I haven't seen him for years. Gee, I know him as well as I know anybody in here. Can I get that name for you later?

He works for Main.

Q He works for Main now?

A Yes, he works for Main. He is in our instruction supervision department.

Q Out of the Portland office?

A In the Boston office.

Q You may think of it; just let me know. If you don't think of it, you can tell Mr. Hoch or somehow get the word to me.

A Okay.

Q For Tucson Gas and Electric, what had you done?

A We made an evaluation of the alternate development plans for the system, combination transmission, generation, alternative timing and dates and so forth.

Q That was a big job?

A Well, actually it was a relatively small job, but it was extremely difficult because of many, many, many inter-related, interconnections with surrounding companies here, and we also designed transmission lines for Tucson Gas and Electric.

Q Does Tucson Gas and Electric interconnect even indirectly with any of the five companies involved in the Colstrip project?

A Indirectly, they are all members of the WSC, which is the Western Systems; but within this group, no, I don't think there is any relationship whatsoever.

Q What system does Tucson Gas and Electric interconnect to the north with?

A Arizona Public Service and the Bureau of Reclamation, Salt River Project, I am not sure whether we connect to any of their lines or not, I don't think we do.

The Public Service Company of New Mexico in New Mexico and actually Southern California Edison comes into our Four Corners, we have part of the Four Corners; so all of the companies in the Southwest are interconnected at Four Corners in one way or another.

Q I understand that is on the WSC system?

A Yes.

Q And more particularly with respect to ?? the Bonaville power construction and all of the companies serviced there, and interconnect that there is an agreement and provision for servicing interconnections, for an example, the Pacific Power and Light Company in Wyoming and Utah should interconnect with systems to the south of them with whom Tucson Gas and Electric should happen to connect to the north, that in that sense there is a direct connection?

A Oh, yes.

Q Do you believe that occurs?

A All these companies are connected indirectly through the interconnected system.

Q And the nature of the indirect interconnection is such that it could occur on such occasions that power would flow from Canada in the north down to Tucson Gas and Electric in the south?

A Yes. Power, of course, flows wherever it wants to flow. In point of fact, it has a tendency to flow from the Wyoming area down through Utah and towards Los Angeles and back up along California into Oregon.

Q Okay. And for Pacific Power and Light Company, what kind of work had you don?

A Primarily box feeding work on power plants in Wyoming. This was mostly work that I have not personally been involved in, but it has to do with various modifications to our power plants.

There was a treatment requirement that is relatively new that has been introduced and so forth.

Q In connection with the Colstrip project, it was Main's desire, was it not, and yours specifically from the Portland office, to obtain the contract to build the generating facilities, to do the environmental studies and to have the construction management for the job?

A Yes. Let me detail that a little bit.

Q Yes.

A Our original proposal was to make the environmental impact statement, do the analytic studies, the engineering design and construction management for the transmission facilities.

Subsequent to submitting the proposals, the company decided they could not separate the plant and transmission, environmental impact, but these had to be looked at as one and we then supplemented our proposal to also do that.

As it turned out, they selected Westinghouse to do the environmental impact for the power plant and transmission facilities, and Main was selected to do the design for the transmission facilities, but not the construction at that time. But it came later on.

Q And the power plant construction was something Main also wanted to do?

A Units one and two had already been committed to Bechtel. We did make a proposal on the construction for units three and four. We didn't get it.

Q Right.

A Okay. Win some and lose some.

Q You got a piece of the action?

A Yes.

Q Now, in connection with the meeting

that occurred in Charlotte, North Carolina in Main's office in February of this year, discussing your testimony for the Colstrip hearing, in your discussion with Mr. Graybill earlier this morning, you recall the conversation with John Evans?

A Yes.

Q And I recall your testimony to be that you told Mr. Evans that there are others who can testify as well as you?

A That was my opinion and I had found out that I wasn't going to have much time available down here.

Q Who did you think could do the job?

A Well, as I mentioned in the early part with Mr. Graybill here, George Nesgos had been in charge of the analytical studies and really covered that area.

Gene Zobel had handled the transmission design elements, and Chuck Taylor had handled the substation design. I felt these three individuals, both Nesgos and Zobel worked on this project from the first day, Chuck Taylor came on board a couple of months later. And I felt these three individuals could give you all the answers that I could give, and in view of the fact that I would have great difficulty getting away from here and that they ought to plan to use these three individuals.

Q Speaking in terms of the great difficulty that you have in getting away from your assignment and responsibility that Tucson Gas and Electric, do I correctly assume that this is the reason that it has been somewhat difficult for us to set up your deposition?

A Oh, definitely. Two things. Number one, we are in some crucial negotiations here that may take the rest of the year, and things can break any day, and we are very, very reluctant to let up.

Number two, I felt confident these three individuals could give you all the answers you needed. On that basis, I didn't think it was necessary that I should be available.

Q All right.

A Okay?

Q Well, we are glad that you are now available giving us some of this information.

Assume, if you will, Mr. Greve, Mr. Nesgos is off to Iran for C. T. Main, not available to testify at the Colstrip hearing. Now, does that affect your judgment as to the availability of the team of the three to cover the field?

A Well, I believe that Mr. Nesgos's testimony can be made available by Main at the client's sole request.

Q Inasmuch as he remains an employee?

A Let's put it this way: if I were still with Main and I was in Iran, I would probably be called back again.

Q Okay.

A I would because Main does work all over the world, but that does not mean that he couldn't be made available whenever you needed him. He probably won't like me for that.

Q Now, in discussion with Mr. Graybill with respect to Exhibit 1 for your deposition today, you described that Mr. Nesgos had done some studies climaxed in the memorandum of May 31, 1971 in which he described additional system loads.

Do you believe Mr. Nesgos did some studies independently with respect to load forecasting for the Montana system?

A No. I think you misunderstood me. If I said that, I don't think he made any studies on additional system loads. What he had was system studies where essentially all the load input from the power company and what Mr. Nesgos did was make a judgment that if we started out with two three hundred megawatt transformers that it would need to add a third one somewhere along the way, and logically that should be at Helena.

Q Okay. You might want to take a look at that Exhibit 1, Mr. Greve, May 31, 1974, a letter to John Evans from you, but I take it you simply pass on data that you got from Mr. Nesgos?

A Yes, in this particular case, I did.

Q Okay. Do I correctly understand now that what Mr. Nesgos did was to help you to respond to a letter from the Bureau of Land Management that asked specific questions with respect to projecting into the years 1990 and even beyond?

A That's correct.

Q And in order to do that, he obtained from the Montana Power Company its projections of what its systems load could be at that time?

A Yes. I think we had some projections of that kind and, however, what he is talking about here is early '84 and that's the early '80's, that is a short time down the road. He is not trying to be precise.

What he says here is that the early mid-80's, which could be a range for several years. You need another transformer somewhere.

Q What I am trying to make clear in my mind is that C. T. Main did no independent load forecasting for Montana Power Company.

A That's correct.

Q Or for any of the Colstrip management team of five.

A No. I think that is correct.

Q When you said to Mr. Graybill that some additional system load would be necessary, that is based on the assumption of the accuracy of the data given to you by the Montana Power Company.

A Yes. However, you don't have to be even accurate to know that if the growth continues as it had, it needs this additional capacity in the approximate time frame, but we relied on the forecasts of the power company.

Q All right. Okay.

Now, you, in connection with this discussion with Mr. Graybill, had said something about stepping down from a five hundred to a two hundred and thirty kV substation at Broadview or Helena. Would you elaborate on that for me?

A Well, okay. The plan is to locate one substation at Broadview and one at Helena. Basically the two five hundred kV lines from Colstrip to Hot Springs needs to be divided in approximately equal thirds.

This is so that if you lose one circuit you don't lose more than one-third of that circuit between the two remote points at one time, and so at approximately third-way points you need to have two switching stations.

Now, it happens that in the Billings area there is a substantial load, additional generation, and it is a logical point for a step-down station.

Q What do you mean by "step-down station"?

A Where you can transform the power from the five hundred kV lines down to two thirty.

Q You do that because the two thirty system happens to be there?

A Happens to be there and happens to be a good place to distribute the load to the users in Montana.

The Helena area is another good location but initially you don't need a step-down at both locations. Eventually you will need a step-down at both locations. Helena has both one fifteen and two thirty lines going by that general area.

I don't believe we have pinned down the substation location at Helena as yet. That is one of the things that was being looked at that has not been determined finally.

Q Is this line now being designed to permit a step-down from five hundred to one fifteen in the Helena substation?

A The line design does not include a step-down, but just provides space and room for it in the future. My guess would be that you step down both to two thirty and one fifteen. That is provided you get within reach of that two thirty line going up to Great Falls.

Q And if you don't get within reach of that line, then your step-down at the moment would be, only require servicing of one fifteen system around the Helena area?

A Yes, yes. As you recall, there is two one fifteen circuits between Anaconda and Great Falls, but you step down in the middle, in effect you get lines that are half as long and you get two in each direction.

Q Right.

A That's a reasonably good plan.

Q You also said to Mr. Graybill something about the possible necessity of developing loads nearer to generation. What did that mean?

A No, I said that was in response to his question, whether unit, the fifth unit had ever been considered.

Q Yes.

A I was saying that the transmission system simply wouldn't carry a fifth unit unless you have a load right near where the generation is. In other words, if you put a five hundred unit and are contemplating transferring this power across the street, you have to do some redesign in the transmission facilities.

But if you happen to have a load right at Colstrip that the fifth unit would serve, why, then, you don't need additional transmission facilities, and of course, that gets out of the scope we were looking at.

Q Okay. Then you had some discussion with Mr. Graybill about a memorandum of November 17, 1972 and the records should show that the memorandum is an exhibit to the deposition of George O'Conner taken a few weeks ago in Montana.

A I don't recall the memorandum.

Q That was the one of November 17th,1972 that you didn't recall having seen before.

A Oh, yes, yes. I haven't seen that before.

Q It dealt with an addition of a fifth,

sixth and seventh unit.

A Yes, yes.

Q For an additional twenty-one hundred megawatts of capacity.

A That was an apparent consideration at that time.

Q Yes. Okay. Now, in discussion with Mr. Graybill about the memorandum from Mr. Zobel of March 30th, 1973, which was Exhibit 19 to Mr. Zobel's deposition, your conclusion was that the three-hundred-foot corridor was determined to be more economical than the two-hundred-fifty-foot corridor; is that correct?

A Well, there were several aspects involved, both reliability and economics. One of the advantages of having two lines of corridors is that you lose one, you have another one, and we had made some studies of what would happen if the tower would fall.

Now, towers can fall in different ways and the only thought was to design for as narrow a right-of-way as possible from the simple point of view in some places it is hard to get rights of way, but when we have a good look at the land we could conclude it would be a lot more economical to go to a slightly wider right-of-way and space the towers a little bit more so that if one fell it would be unlikely to affect the other.

Q In discussion also with Mr. Graybill this morning, with respect to ozones from transmission lines, I believe you told him that you obtained some data which you transmitted to Mr. Evans, you were confident that he had transmitted this to the Department of Natural Resources.

A This was in response to one of your letters asking for details.

Q I don't share your confidence about the transmittal from Evans to the department, but what was the nature of the data that you obtained?

A I don't recall the details of that, but there have been measurements of ozone concentrations at the line conductor level and various distances away, and as I recall it is based on the configuration of the conductors, et cetera, an estimate could then be made of what you would have for this line.

My recollection is that you couldn't estimate any measurable amounts. I don't recall the details of this.

A In connection also with Mr. Graybill's discussion with you earlier this morning, you looked at a memorandum of July 20th, 1973 from Mr. Zobel which is Exhibit 18 to his deposition, discussing the preferable conductors, and you described to Mr. Graybill how the original preferences had to be changed because of availability of material.

A Of material to a large degree, yes.

Q Of course, availability of material refers also to lead time in which you could obtain the material?

A Definitely.

Q At that time, in the summer of '73, the lead time availabilities were a real problem, were they not?

A Yes, an extreme problem.

Q But in the, practically two years that has intervened since that time, availability has become much less of a problem and lead times have shortened, haven't they?

A This is a problem, it happens to be a very special high-strength steel cable for the reason that manufacturers in this country stopped making them.

Q If you were making the decision today, May 2nd, 1975 as opposed to July 20th, 1973, on what configuration conductor bundle to use for the Colstrip transmission line, do you have an opinion as to whether you would still go to the mallard four bundle conductor?

A I am quite sure we would go to the mallard for the reason, another factor now is predominating is the high cost of money and much higher cost of energy that you have to predict into the future.

You look at a line over the life of the line, I think the conductor selected is still good. Now, I should point out to you that when you look at several transmission line designs with different size conductors, you get different costs per mile and it becomes a curve as you go from this small conductor to a larger conductor, the costs will go down and eventually up again. The minimum is a very flat minimum and you can pick several conductors that are near each other in size, and so you wouldn't radically change from one to the other, with small changes. But I think the seven ninety-five is a sound choice.

Q And now I take it your view would be that that is a sound choice because primarily of the high cost of money and that you will, therefore, lower the loss of energy?

A That is correct.

Q As a result of the mallard?

A Without going over the calculations

again, I am fairly confident that is the way it will come out.

Q Okay. Then in discussion with Mr. Graybill earlier this morning, you talked about the nature of some of the tests that were performed on the towers where there was usually a high number of failures that were of some concern.

Are you familiar with the term destruction testing?

A Yes.

Q And do you know that some of the tower designs used for the Colstrip transmission line were not subjected to the destruction testing?

A Yes. We only -- there is a total of eight designs, we only tested, I think, three. The reason being that the others are cousins with minor changes in span and loading, and that what you learn from one you can transpose into the others.

Q The amount of tests that had to be conducted by the American Bridge Division under your supervision, Mr. Zobel's particularly would have been a matter for decision by Mr. Zobel for C. T. Main, isn't that true?

A Yes. I think this was Main's recommendation, and yes, it was a matter of discretion. In comparison, we tested more towers than,for an example, PP&L for the bridge lines and Bonaville for the double circuit five hundred kV line.

Q Are you aware, Mr. Greve, of a notice published in the Federal Register on March 18th, 1975 of the study to be conducted by the Environmental Protection Agency of the United States on Health and Environmental Effects from EFV lines?

A I am not aware of the notice, but I heard they are entering into this field.

Q Does that cause you any concern?

A Well, concern with respect to what?

Q Anything.

A It would certainly delay the project.

Q Why?

A Because it will take a very long time for them to convince themselves that what is being done is in fact good practice. Maybe not. I don't know, really.

Q You think that they are going to convince themselves, though, of it?

A Yes, I am fairly confident of that.

Q Okay. Are you familiar with the publication called Electric Light and Power?

A Yes, I am.

Q And in the August, 1974 issue of that

'?

publication there was an article by Michael Morgan entitled EHV and the Environmental Effect of the Tip of the Iceberg?

A I believe I have read the article, at least I think so. I see some signs there so this looks like one I have read.

Q Right. Did you have any concern raised in your own mind as a result of that article or similar articles over the last couple of years with respect to whether it will be useful further to examine the possible environmental effects of EHV lines?

A Well, I think that enough questions are being raised in areas that perhaps have little data available that they need to be answered, and so this is, I believe, what the EPA is entering into.

Some work has been done for almost ten years at Johns Hopkins University with respect to biological effects in the electrical field, and I am not aware of any information that shows this to be detrimental in the type of field strength that you normally encounter under transmission lines.

But some studies are continuing in this area.

Q If there were such conclusions mainly in the field strength that you encounter under EHV lines such as those proposed for the Colstrip project, would that tell you that you ought to get back to the drawing board and design different types of safety features into your lines?

A If there were detrimental effects?

Q Yes.

A Then you certainly would take them into account. Now, I believe that the concern expressed has been with regard to the electrical field under the line and the easiest way to avoid that is a matter of increasing the clearances. We have already increased the clearances quite a bit over that which is required by the National Electrical Safety Code.

Q What is the clearance, for an example, on the Colstrip line?

A The design clearance is thirty-seven feet over open fields. I believe we have over forty feet over all road crossings.

Q Are you aware of the proposal that utilities should formulate a plan to provide an additional safety corridor adjoining existing right-of-ways?

A You mean with respect to increasing the right-of-way, in effect?

Q In effect, it would be called safety corridors under the proposal.

A In the State of New York, some proposal like that has been put forth and in comparison, I know of a seven sixty-five kV line which if it were to comply with the suggested rules would require a thousand feet of right-of-way.

I am not sure, these things have been sought through in great detail, and that's one of the things that has been kicked around.

Q At the moment.

A Another suggestion has been to fence the right-of-way, which I am sure would be opposed by the landowners, and various things like that, but really there is no data that tells you that tells you that is important to do that, just questions asked, should it be done, some research that has been started on it.

Incidentally, Gene Zobel is on the committee which is communicating on this subject with Russian scientists who also have done some work in this area.

Q We had some discussions with him about that on his deposition.

A Okay.

Q Do you personally have an opinion at this time whether such a proposal, namely that of a safety corridor in addition to rights-of-way is a good thing to consider?

A There are thousands of miles of five hundred kV lines and many, many of them have been up for at least ten years. I know of no detrimental effects from five hundred kV lines. I would say from five hundred kV lines and below, I would consider that unnecessary.

I have no opinion on seven sixty-fives, but I know of no particular reasons why you should have it there, either. We are considering voltage at eleven hundred and fifteen hundred kV's, and I think we are now getting into the range where the unknown is being probed; but when five hundred kV, I believe there is substantial data available which would not justify going this route.

Q Are you aware of a study entitled the determination of ozone production by high voltage power transmission lines, done under a contract with the EPA for the Office of Research and Development of the EPA by Mr. Whitmore and Mr. Duffy?

A Not that I can recollect at the moment.

Q What are your views, Mr. Greve, on the relative environmental impact of DC versus AC transmission lines?

A You are comparing one line of DC versus one line of AC? I don't believe there is any significant difference in the environmental impact.

Q Have you, yourself, read any of the papers that have been delivered or prepared by any of the Russian scientists with respect to the effects of EHV lines on human beings?

A No. I only read about them. I have not read them directly.

Q Do you think that the data generated in those papers was worthy of close consideration?

A You certainly can't pass over them. I understand there was a meeting between the American and Russian delegates on this subject very recently, perhaps in the last month or so, and that there is now some real question on whether the Russian data in effect are comparable to ours. It depends on how they are measured and it may be that in fact they have a higher strength than have been assumed, but the method of measurement enters into it so there is a real foggy area if you really have any comparable data to look at.

Q There is another meeting being arranged for in the latter part of this month in which some of the American representatives are going to Russia. Are you aware of that?

A No, I wasn't aware of that. This is part of the continued research in this area.

Q What does the term "redundant transmission" mean to you?

A I am not sure. We talked about redundant members in steel towers which basically do not carry any loads, but are there to limit lengths of various members.

Redundant transmission might be a line which does not carry any load normally except perhaps in an emergency, doesn't have any other meaning at this time. I am guessing.

Q Do you know why, Mr. Greve, Russ Wolfe would have requested that the Montana Power Company send you drawings of gates or cattle guards used by Montana Power Company when fences have to be cut?

A They were for inclusion in the construction contract.

Q Why would you want those?

A To show the contractor what type of gates and cattle guards to provide.

Q What does reference to fences that have to be cut, why would you be cutting fences?

A Well, in the construction of the line, you may have to have a right-of-way that goes across a number of properties in order to transport equipment across there, you have to cut a fence, and of course, that's usually done with the owner's permission.

Q Hopefully.

A Every now and then, people slip on that.

Q Who is Mr. W. A. Woolford?

A That rings a bell on who, he is in the Main's Denver office, he is a right-of-way expert, land acquisition man.

Q Do you recall some discussions or correspondence with Mr. Woolford on problems that were being encountered with respect to what rights-of-way are necessary or should be done in connection with your transmission lines for the Colstrip project?

A Yes.

Q Can you describe those for me, please?

A Well, as I recall it, we had a subcontractor, perhaps still do, for the acquisition of rights-of-way, and allegedly one of the subcontractor's people had approached landowners in such a way that the landowner complained to Mr.

Coldiron, and Mr. Coldiron jumped on me and I decided we had better get somebody in there to go over the procedures with the land acquisition contractor.

I got Mr. Woolford up from Denver, he is the man who has long experience and history in this. His conclusion was that the subcontractor was doing exactly what he was supposed to do and that we happen to be up against unreasonable customers in this particular case, but that is the best of my knowledge, that is the gist of the conversation.

Q Do you recall the conversation in which Mr. Coldiron reportedly said if the subcontractor -- who was Dale Heston --

A He was one of the employees.

Q Right.

A Heston was in charge of that group.

Q Heston was in charge of the subcontractors group, and the subcontractor was called UFS.

A Universal Field Services, that's correct.

Q And you recall Mr. Coldiron said that if Mr. Heston mentioned condemnation to an owner, that Heston would be fired on the spot?

A Yes, apparently. Apparently it is not

the subcontractor's decision on whether or not condemnations will be involved or not, and that was one of the, you might say, unfortunate approaches this guy had used.

Q Why so gunshy about condemnation, isn't that legitimate?

A It is, but it was not his right to exercise it, that would be the right of the power company to exercise matters here, who is authorized to do what.

Q Was it not C. T. Main's main function through the subcontractor, UFS, to apply reasonable pressure on the owners in order to persuade them to sign easement agreements?

A It was to assess and negotiate a purchase price for the land, but the actual transaction would be between the power company and the landowner, simply a matter of augmentation to the power company's own land acquisition force.

Q My question to you, Mr. Greve, was it not C. T. Main's function through the subcontractor, UFS, to apply reasonable pressure to the owners in order to persuade them to sign easement agreements?

A I never thought of it in those terms. The rate for the land offered by the power company was exactly the same wherever they went in and what the land acquisition people's function was, was to explain to the landowner what would be involved, where we would like to put the line, of course, to see if he would agree to an easement, whether they were ever instructed to put pressure on them, I don't know. Certainly not by me.

(Exhibit Number 7 was marked for identification.)

Q (By Mr. Shenker): This Exhibit 7 marked for your deposition, Mr. Greve, is a memorandum of March 11, 1974 from Mr. Woolford to you.

Do you recall having received that memorandum?

A I see it in front of me, yes, sir.

Q At the bottom of the page there is marked, I will relate to you that the markings are not as they appear on the original memorandum, but have been placed there subsequently, the last sentence in the fourth paragraph, "In the meantime UFS personnel are seriously hampered in their attempts to apply pressure to owners in order to persuade them to sign the easement agreements."

A Yes, I think that bears out what I just said, we never instructed these people to apply pressure. Perhaps they felt they should, perhaps Mr. Woolford apparently felt they should have such instructions. But in point of fact, their job was to try to establish the sale or purchase of an easement, and if they didn't get anywhere, it would go back to the power company for decision on how they would handle that case.

I think at this particular time we had, you might say, gotten the agreements from all those who were agreeable and things were going very slowly as far as getting additional lands. These people apparently felt that pressure had to be applied but Mr. Coldiron was against it, he felt that shouldn't be done, it wasn't their area.

Q As far as you were concerned, you thought UFS people were trying to do a good job, didn't you?

A Well, I did call in Mr. Woolford to make sure that was the case, and his memorandum, after he had reviewed their work, he apparently felt that they were doing exactly what they should be doing.

I was inclined to side with Mr. Coldiron. Maybe they had big feet out there and could have gone a little more gently, we so instructed them subsequently and tried to keep good relations.

Q The reason for your concern, I take it, it would be that the project was running into opposition which might slow it down and you didn't want that to happen?

A It is very difficult to stay on schedule if you don't have the land available.

Q Right. Well, you knew by early June of 1974, did you not, Mr. Greve, that no work would be done for acquiring land in Broadview until there had been approval of the proposed Colstrip units three and four and their transmission line locations?

A That was decided by the power company, yes, sir.

Q They told you that,didn't they?

A They basically told me that. I was -- okay --

Q Do you recall, Mr. Greve, some problem with the TV interference on a portion of the transmission line that affected a Mr. LeFeld?

A No, I do not recall that.

Q Let me show you the letter of July 22, 1974 that John Evans sent to you attached to a copy of a memorandum that Mr. Couture was in the acquisition right-of-way sent to Bill Coldiron referring to arrangements for a couple of TV specialists from Billings to help out Mr. LeFeld's problems. Does that refresh your recollection?

A This was to do with the Billings-Great Falls two thirty kV line right-of-way. This was not part of the Colstrip Project within the scope of work and as assigned to me.

However, since the land acquisition for the Colstrip line had slowed down considerably, I wanted to take the people off the job and essentially send them back home; but the Great Fall line land acquisition which was handled by the power company itself, needed some manpower so it was agreed to transfer this fellow John Vincent to that effort, he would continue to administer Universal contracts, but he would work directly for the power company.

I think this was just sent to me for information. I have no recollection of it except when I see it here.

Q Do you know whether anything was eventually done to solve the TV interference problem?

A This particular problem or in general?

Q Both.

A No, I do not know. I do believe that

we recommended to John Evans that he should engage someone to measure interference as it exists today before any lines are built.

Also after the lines are built, but before they are energized, and also after they are energized for comparative evaluation.

Main could do this work or he might prefer to engage somebody locally who might have more credibility with this particular area. It didn't make any difference to us in that sense.

Q I take it that Main has not, to your knowledge, been engaged to do that work which you proposed?

A That's correct, not to my knowledge.

Q What does the term "series compensation" mean?

A Well, a long transmission line has a high impedance series capacitors inserted in the line which electrically reduces the impedance between the two inputs.

Q Does forty percent series compensation mean that you are doing a better job of reducing the impedance than thirty-five percent series resistance?

A It means that you are reducing the overall impedance by forty percent versus thirty-five percent, not necessarily a better job.

It is an area that has to be studied to find out which is the best number.

Q Do you recall some discussion with John Evans on the subject of taking a look at the General Electric units for Colstrip one and two under the overall, I guess a stability study that was to be done in connection with units three and four?

A Yes.

Q Why did anybody want to look at units one and two?

A Well, there was a problem known as subsynchronous resonance, which occurs when you put series capacitors in a line and basically you get a resonance between the elements in an electrical circuit and the mechanical elements in the generating units, and this would apply to one, two, three and four, any generating units that are at the terminal of the line.

For that reason, we had to get the characteristics data from G.E. on generating units one and two.

Q Did you obtain that data?

A Yes, I think so.

Q What did it tell you?

A Well, it basically gave us the mechanical characteristics of the turbine generator and shaft that was imputed into a Westinghouse study and they, of course, the Westinghouse supplied additional information for three and four. It told us that series compensation -- well -- various levels of a series compensation can get the resonance with the mechanical characteristics of the unit, and those that have a series compensation should be avoided or you may have to compensate for them in a different way.

This is a, incidentally, one of the reasons why it would be a very questionable matter to consider a fifth unit at the end of this line.

Q Because it won't work in with the first two units?

A No, because to get the power from the first four units across the system, you need about thirty-five percent series compensation. You get up in your higher loads of series compensation, you have more power, but then you get into the resonance frequencies which would give you difficulties.

Q Were tests eventually performed to provide various parameters for settings with respect to the G.E. units in one and two and

Westinghouse in three and four?

A Yes, some tests were conducted, oh, it must be a year ago or maybe more. There were some additional tests to be conducted by Westinghouse towards the end of last year. They may or may not be available now. I have not seen the final results.

Q You know Mr. Ralph Geens of the Bonaville Power Adminstration?

A Yes.

Q You have met with him from time to time in connection with the Colstrip project, have you not?

A Yes, I have.

Q Do you recall the discussion with Mr. Geens in which he pointed out that the Bonaville Power Administration had planned to install a braking resistor at Hot Springs, and they thought it would be a good idea if you establish a resistor at Colstrip?

A I don't believe -- also I think there was an alternative. He needed one at Hot Springs to protect his system, it would do the same job at Colstrip. I think he was exploring the possibility whether they would like to put in one at Colstrip.

Q What was your reaction?

A Sort of six of one, half a dozen of the other. I don't recall that we had any fair reaction to that particular point.

Q Showing you the Minutes of a meeting of October 16, 1974, system planning which was held in Portland, the meeting which you attended for Charles T. Main and Mr. Geens attended for Bonaville Power Administration,among others, you see on page four of those Minutes Mr. Geens stated that the PBA had plans to install resistors at Hot Springs and stated further that the resistors if placed at Colstrip would help even more?

A Yes.

Q Does that mean to you that instead of putting them into Hot Springs, it would be easier to have it at Colstrip?

A Yes, from the point of view of the Bonaville Power Administration System.

Q Why?

A Well, if you have a fault on the system, momentarily the voltage goes way down, the power still continues to flow through the turbines since it has no way to go, that the power output from the generators, there is no way to go, the machines speed up, if they speed up sufficiently, the system loses its synchronous system, there are various ways of combating that, and one is to have a strong enough system, even though the machines speed up they aro pulled back in again.

Another one is to drop one of the generating units so that you have less power being distributed to the system.

The third way is to put on a big load right where the machines are to absorb this excess power until you get the line restored again. This big load is a braking resistor.

Now, Mr. Geens' system at Hot Springs receives power from Hungry Horse and it takes it a long way down to the southern edge of the Bonaville system to several other power plants.

There are areas in the Bonaville system from a fault on the line would shake these power plants around, and rather than drop the generating units, they prefer to put on a braking resistor.

By the same token, the Colstrip unit would be shaken around, and therefore if they had a braking resistor there, it would do an additional job. I am not saying you couldn't put it at

Colstrip, but we haven't made any particular study on whether we want to have it there.

Q It would cost a little more to do this?

A It is one of those things, if we need one at Hot Springs, anyway, you might have them by them and stick it in where they would like to have them.

This is a consideration, but I don't think it is too critical one way or the other, except from the point of view of aesthetics. That is a monster, it's a great big Christmas tree of electric wires, and you know, like a big space heater about the size of a big transmission tower.

Q Is there space to put that monster into the Colstrip terminal?

A You have to make a special location for it. As I recall, the one at Bonaville, the last one they built, like two towers, have a network of wires between them which are resistance wires, a big resistor.

Q Okay. What is a three-second rating of seven hundred and fifty megawatts?

A That means you could pour seven fifty megawatts through this resistor for three seconds without burning it up. They only plan on having it on for one second.

Q Why would you want seven hundred and fifty megawatts running through it?

A It's just a good number, and it is equivalent to dropping a generating unit, for an example -- well,we made some tests on the stability of the Colstrip system and for certain -- well, okay.

You always have to consider that things can happen that you don't design for, like we always design for losing one line, but suppose you lost two or even had a fault hanging on that that did not go off,then you have to have a second line of defense, and ours would be to drop the generating unit with a braking resistor.

We could use that. But the second line of defense is used very seldom. It is sort of a debatable thing, which is the best way to go.

Q I am trying to focus on why at that time number seven fifty instead of seven sixty, why seven fifty?

A Well, we had -- it hadn't really been studied in fine detail at Colstrip when we made stability tests with double contingencies, that is more than one fault in the system, at least two events involved, we would drop either the small generating unit, which was about three hundred and thirty megawatts, or the big one which was about seven hundred megawatts.

Seven hundred and fifty, we dropped one or the other and we see how much we need to drop to ride through the problem.

Bonaville has built a braking resistor which is about fourteen hundred megawatts.

Q Where?

A It's near the Dowls -- I'm pretty sure it's at the Dowls Dam.

Q At the Pagetty Substation?

A I am not sure exactly; I've only seen -- my recollection is it's at the Dowls Dam, there, the big power plant switchyard.

Now, seven fifty is just a trial number.

Q Now, taking a look at the history of your plan to build kV circuits itself --

A What do you mean by that?

Q Well, I am trying to find out. Is it true that at the beginning of your work a plan was to build into the circuit a five hundred kV transmission line from Colstrip to Broadview in addition to a two thirty kV single circuit from Colstrip to Coret?

A That is the basic plan now, yes, the

two thirty line was designed by the power company.

Q Initially the two five hundred kV would have operated at two thirty kV?

A That's right. They would be built into Broadview, essentially, and just operated at two thirty kV until the third unit came in.

Q Now, it doesn't make any sense to construct two five hundred kV circuits from Colstrip to Broadview if you are going to operate them at two thirty if you are not going to have units three and four.

A Of course not.

Q It would be a substantial capital investment.

A Yes.

Q And not sensible at that point.

A That's right. This was recognized in the spring of '73 when the environmental law in Montana was passed.

Q Yes. Therefore, to indeed broaden that more, even if the Colstrip units three and four were to have been delayed?

A Yes.

Q Much less postponed, you would have had an unreasonable capital investment by putting in initially five hundred kV circuits, two single five hundred kV circuits if they were going to be operated at two thirty.

A It depends on the length of the delay, but that is correct. If the delay was long enough, then that might not be the most economical way to go.

Q Right. So your analysis then was that the initial solution would be to operate a two hundred thirty kV line from Colstrip to Coret, this is the one you did not design?

A That -- all right, I think --

Q The construction of three two hundred kV lines from Colstrip, and deferring it unless units three and four were ever going to be constructed?

A I am not sure of your question, but if I may, I will --

Q I am trying to ask if that was not your analysis.

A How it came about basically, the original plan was to build two five hundred kV lines from Colstrip to Broadview, and operate at two thirty kV until such time that units three and four came along and they would be converted to five hundred. Of course, also extended to the Hot Springs, when it became apparent that three and four might be delayed, the question was raised whether we really need three two thirty kV circuits for the first two units, one and two, the studies made showed that, yes, we did indeed need the three two thirty kV circuits, and then the question was should we build with pole lines initially and go the five hundred kV route later on, or should we go ahead with the five hundred kV lines now.

And then we came up with the third solution that was to build only one five hundred kV line, but string it for operation as two thirty kV circuits, that would give us one line to build instead of two, and we would still have three two thirty kV circuits on an economical analysis.

Originally it showed that if units three and four were delayed no more than '81 or '2, this would be the economical way to go.

Last fall at one point in time, I remember checking those economic calculations because of the difference in cost of money. On the latest cost it would, you could delay three and four to about '84, '85, and still have made the right choice going with one five hundred kV line strung for two two thirty kV circuits.

Q Single circuits?

A Yes, operating as two thirty kV single circuits.

Q I believe, Mr. Greve, that there has been some prospects that bulk power could be routed from Colstrip through Wyoming and Southern Idaho.

A No. I have some knowledge of the Idaho system and the system west of Idaho. There is no existing transmission capabilities there that would absorb this bulk power if you were to build lines of this kind, I think you would have to go all the way to Oregon.

Q Exhibit 1 to your deposition, a letter of May 31, 1974, on page two, paragraph three, refers to the prospect of bulk power routed through Wyoming and southern Idaho to Pacific Northwest.

A Yes.

Q But you never thought that was a reasonable prospect, did you?

A I think I said it is electrically feasible, but no, I didn't think it was a reasonable prospect.

Q That is as a result of your knowledge of the Idaho system?

A Well, yes. I think you could say that.

Q In the fourth paragraph on that same

page, you say that the proposed five hundred kV lines do not replace the existing two thirty kV system in any way. By that you meant to refer to a two thirty kV system that was already constructed, did you not?

A I say existing and that would mean those constructed.

Q You did mean that two thirty kV line, for an example, well, we were just discussing that, you propose to build from Colstrip to Broadview on this interim basis?

A No, of course not, they don't exist. If the five hundred's were not built, then something else would have to be built.

Q In that same paragraph, you point out that the five hundred kV transmission lines represent an express way for bulk power delivery to the Montana system and points west and the existing and planned two thirty kV system will be required for distribution of this power within Montana.

A I say existing and planned two thirty kV, that is including the Billings, Great Falls line, and I guess somewhere down the road you have to build an additional line, but -- yes, I am not sure I answered your question.

Q I think you did. Thank you.

The next page, which is a continuation of the fifth paragraph, you conclude the power produced at Colstrip would be displaced by power produced elsewhere. What do you mean by that?

A Well, the total generation at Colstrip, as you know, is assigned to the various companies, two companies, they each own half of the first two units, five companies own a share of the next two units.

Now, this would provide, as I recall it, enough power for Montana to get their requirements up through, I'd say here about the mid-1980's. As I recall, it was about '84 or '85.

In '84 or '85, the Montana Power Company would have to get an additional generation from somewhere. Now, one of their choices then would be to, say, participate in a plan, for an example, the nuclear plant they are planning on building near Seattle.

I have no knowledge of what their plans might be. If they did participate, in fact the kilowatt hours produced at Colstrip would not be there and remain in Montana and that is what I mean by displacement. More and more of the Colstrip power would be used in Montana.

Q At this point you would have the express way for five hundred kV lines that really weren't necessary because you would be delivering a two hundred thirty kV system, wouldn't you?

A Well, if you are delivering two thousand megawatts in Montana, you need a lot more than the two thirty that is there now.

Q You still need the express ways, then?

A I think that these particular lines, I am not saying that you couldn't come up with a different plan, but these particular lines do provide feed-in points at three points, Broadview, Hot Springs and Helena, and eventually feed into the Montana system.

Q What you are looking at is the possibility with the displacement of power as you have described it, you might want to have a freeway plan, called in automotive terms, a peripheral freeway around the community, and the automobiles then feed into the community at various exit points, limited access, that is what you are talking about in terms of power delivery?

A I think that is a good -- yes, I think that is a fair comparison.

Q Okay. Now, do you recall a discussion with Ralph in which he indicated that BPA had experienced some three hundred faults on its one thousand mile five hundred kV system over an eight-year period?

A Yes, I have asked him for, like that information, to determine what type of faults they had experienced.

Q Did that seem heavy to you?

A Well, that's a good question. I would like to sit down and calculate that, but yes, I thought it was a rather large number.

Then again, they have over twenty-five hundred miles of five hundred kV lines.

Q That is a thousand miles he was talking about at that time?

A How much?

Q A thousand miles.

A Yes. Well, they have over twenty-five hundred miles there.

Q But he was describing it over an eight-year period over a thousand miles of line?

A That is about four faults per hundred miles per year. I think that is high. I would like to keep it to less than that in the designing of a line.

Now, you will find some of those faults are not caused by the design of the line.

Q In one of the early discussions on the

Colstrip Project after C.T. Main was awarded the initial job, in discussion with the Colstrip Project management, do you recall a discussion of studies that included a couple of seven hundred megawatts at Colstrip or perhaps three units with one unit dropped following a fault?

A I think at one point in time, we did have a third unit there which we dropped to see if it would be able to hang on.

Q What does that mean?

A It's a matter of testing the system.

Q Does it mean you actually contemplate having three units and one of these does fault and you see if the system works after that?

A No. It means in the event you have a fault on the transmission line, then you get into the condition I have described earlier where the voltage goes down to zero, you can't get the power out of the unit, and they all speed up, and one alternative is to drop one off, thereby removing some of the energy being inserted in the system.

Q Now, you knew, did you not, Mr. Greve, that there was studies under way in 1972 with the Bonaville Power Administration participating, which in effect eventually became the Colstrip Management, on their power flow needs for transmission corridors both for Colstrip and from the Jim Bridger area?

A I am sure there were studies going on. I didn't know of them specifically.

Q Do you recall having reviewed reports of meetings and discussions or were you familiar with a project that two corridors west, either from Colstrip or from the Jim Bridger area, would be required to provide the firm transmission for up to seven thousand megawatts of new generation, approximately thirty-five hundred megawatts in each area?

A Now, these would probably be studies conducted under the WSCC group. I did not have that information available. I have seen maps of the WSCC long-range plan which contemplated some sort of ultimate development in Montana, Wyoming, the Colorado area. But this was planning that I was not privileged to participate in.

Q Does the figure of thirty-five hundred megawatts flowing from the Colstrip area sound like about in the ballpark?

A I don't know that I have had a chance to look at any of that. I do recall when we started to make studies of the Colstrip project as it was assigned to Main, we had considerable difficulties with the data input, much of which had been obtained from Bonaville because similar cases had different load representations.

That meant that one or the other had to be wrong and somewhere in the spring of '73 we had to go back to Bonaville and say, "Listen, you have this wrong here and this wrong here," which as it turned out that they were both wrong. They just changed their plans.

After studies progressed, we had to sort of do several things over again that spring.

Q If you had thirty-five hundred megawatts of capacity being transmitted from the Colstrip area west, you would certainly want to give serious consideration, would you not, to the use of a DC system instead of AC systems?

A I would say that first of all you certainly would. Second, yes, after you have the two five hundred kV lines, if you were to transmit the additional, in this case about fourteen hundred megawatts, that might be just right for the DC line.

The DC question has come up from time to time and the problem is you can carry a lot of power on a single DC line. But if you lose it, you leave everybody in a lurch unless you have a strong underlying system and the strong underlying system doesn't exist.

After you have the two five hundred kV lines, it might be a good plan to look at DC for additional capacity, if it is going to be transmitted out of Montana. You have a parallel example in the ties between Oregon and California, there are two five hundred kV lines and one DC line and they are, within the last month or so, they lost the DC line and in point of fact, the AC lines weren't strong enough to hold it together, so you really have to have a strong underlying system to make the DC line work if it is, you know, part of the system.

Q Well, is it your testimony that you were asked on behalf of C. T. Main, for an example, to propose transmission lines to take at least fourteen hundred megawatts of capacity from Colstrip to load centers in the Pacific Northwest that you would not propose DC lines given the present system that now exists?

A I would not propose one DC line as the first alternative. If you are prepared to build two lines.

Q Two DC lines?

A From the beginning, that would be a

different matter, but now you will find that your costs out there are very, very high and generally speaking the two five hundred AC lines -- let's put it this way -- with a single DC line theoretically you could carry the same amount of load but if you lose it, you have no back-up. You have to really have two DC lines and that cost is way above the two AC lines.

In addition, you have no way of reaching down into the Montana Power System such as the Billings and Helena stations with a DC line. You would have to build an additional two thirty to go alongside of it to reach into those areas, so it isn't -- my feeling would be that if you study this carefully, you would find that the DC lines should not be the first choice. But that doesn't rule it out as a later line, if you wanted to go that way.

Q What is the advantage of a DC line?

A The transfer power, transfer capability of a DC line is not limited by stability as it is in an AC line. Therefore, you can take a long distance or carry large amounts of power without getting into stability problems.

Q How about line losses or DC versus AC?

A Well, this you can make comparable, it depends on the size of your conductor and the voltage you carry on it. You would certainly choose an economical conductor in each case.

(Exhibit 8 was marked for identification.)

MR. SHENKER: I have what is marked as Exhibit 8 in connection with your deposition; it's a letter of March 20th, 1974 from you to Mr. Evans comparing DC and AC costs.

A Right.

Q Now, some fourteen months later, do you still believe that the facts that are reported to Mr. Evans are correct?

A Well, the costs have been escalating quite a bit since that time. I am sure that a list on both AC and DC --

Q The comparison would still be the same?

A I think the comparison would be reasonably the same. I understand that the DC costs here went up, were not provided for by us, they were produced by a member of the Department of Natural Resources.

The basic misconception that he had at this time, he had some data from a line which included one terminal,and a transmission line, and apparently he was not aware that the other terminal had to be built by the receiving power company, and that cost had not been included.

So all we did here was to tabulate the cost comparison, if you included both terminals.

Q That cost comparison, then, and in Exhibit 8 to your deposition, should correctly set forth the data that you don't feel that the Department of Natural Resource person described?

A I think this gives a comparison at this point of time of the cost data. They had been presented with those that we had.

Q Who is Bill Austin?

A That's a good question. I happen to know two or three people by that name.

Q W. E. Austin?

A Who does this fellow work for?

Q The Colstrip Project.

A The line routing?

Q Yes, I think so.

A He was a part landscaper architect, I believe that must be the one, he was a landscape architect and used in the Boston office, and has some experience in selecting right-of-way for transmission lines with respect to aesthetic land use. He also, incidentally, had worked at one time for the Forest Service, I reckon one out of Idaho, I guess he is from Idaho. We included him in the route selection team when we developed alternative routes for the transmission lines.

He was associated with the project for maybe the first six months in that effort.

Q In the very earliest stages of the project, do you recall Mr. Evans informing you that no decision had been made on whether hot line maintenance would be done on the five hundred kV project and asking for your suggestion?

A I don't remember his question, but it was subsequently decided to design for hot line maintenance.

Q Why?

A Because of economics, and because of the ability to keep the line operating while maintenance was being done.

Q Is it correct that in addition to economics or perhaps included within economics the factors to be considered in conductor selection are corona losses, noise generation, and conductor tension?

A Yes.

Q Those are the major factors, are they not?

A Well, of course, in addition to corona losses, a direct current loss, they are greater than the corona losses by and large. But they are also easily determined.

Mechanical strengths, diameters of the conductors is of some importance. I think basically those are the ones. There are many, many little things, but those are the important things, that you just mentioned.

Q Now, you were informed, were you not, Mr. Greve, on the work that was being done by the Westinghouse Environmental System Division, to prepare that portion of the environmental analysis on behalf of the Colstrip Project Management that would involve the transmission lines?

A Yes. We laid out alternative routes, prepared conception designs of the towers, and provided this to Westinghouse for evaluation.

Q You knew that Westinghouse was going to provide, among other things, construction guidelines which would be in the environmental analysis?

A Yes, I think that is correct.

Q In order for them to do that, they had to know what you had in mind for constructing along the transmission lines, didn't they?

A I think we reviewed their construction guidelines which they had used on another project, notably down here in Tucson. That was a coincidence.

Q That is an interesting coincidence.

A No, nobody knew that I was going to be here.

Q As I understand it, what happened was that Westinghouse got some input data from C. T. Main on what the transmission lines were going to do and what the various parameters were for consideration on an environmental analysis, and then they came up with their draft of the analysis, including the construction guidelines submitted to C. T. Main for review.

A Right.

Q Right. And you made various comments which you thought should be changed, modified, added, subtracted, et cetera, is that right?

A Yes,I think that's right.

Q And that's the way it worked, not only in fact but as it was originally contemplated as well, is that not true?

A I believe so. I believe so.

Q Now, you knew that Westinghouse's turbine generator for units three and four was rated as seven hundred seventy-seven megawatts gross, did you not?

A That number has been floating around. Until they actually built those things, I don't think they knew when it was.

Q Was it your original understanding that the first segment of the line from Colstrip to Hot Springs, namely the portion that would go from the first third that you called it Colstrip to Broadview, would not cross any state or federal land?

A I think that question has been asked before, and my understanding is something like that. There are very few state and federal lands between Colstrip and Broadview; therefore, the most convenient way to get the right-of-way would be not to seek these parcels out unless it was economical to do so.

Basically I think we put one foot on a piece of State land along the way, but I think the rest of the route does not touch on State land. Now, that was in the original route, as I recall, and the decision by the Board last fall, about forty percent of that route had to be relocated in coordination with the department. I don't know where it ended up.

Q What do you know about the plans for a pipeline carrying coal from Wyoming to the middle south?

A I have heard talk about plans for a pipeline from Wyoming to the middle south system.

Q What have you heard?

A Well, the middle south system consists of several power companies, Arkansas Power and Light has a plant with four eight hundred megawatt units that Main is the design engineer for.

Louisiana Power and Light has a similar design for eight hundred megawatts. I believe that a third plant is planned down there and consideration was given to building one pipeline to carry coal from Wyoming down to the middle south system.

Q That is a lot of coal.

A A lot of pipe and a lot of coal. Bechtel was the engineer for that particular effort. I am curious why you asked the question.

Q Well, I am asking because you wrote John Evans the letter describing to him some plans for a pipeline designed for carrying coal to the middle south.

A Oh, I remember that now.

Q Now, when you wrote to Mr. Evans on June 10th, 1974, you gave him a report on the subject of conveying coal by pipeline. Who prepared the report?

A Lance Booth.

Q Who is he?

A A mechanical engineer, and he is now in Main's Portland office. He used to be in Main's Boston office. He had been directly involved in coal transportation by pipeline and belts and other conveyance systems.

Q Would you agree with his conclusions that for a coal pipeline to be economically feasible, it would be necessary that large quantities of transport of coal be involved?

A In general, yes. However, there are special locations where you might justify a coal pipeline where you have no other ways of transporting the coal, for an example, by rail or where you have no other, shall we say, access to the mines, for an example, from the Black Mesa Mine there is a pipeline that supplies two eight-hundred megawatt units. It has had its ups and downs in terms of operating, but I guess it's working reasonably well now.

There is no other way eventually to get the coal to those locations, no rail lines, et cetera at the port of origin or at the port of receipt, and you would have to build a railroad almost the whole way as a comparison, so it depends on a lot of other circumstances.

But in general, I think he is right; you have to get large quantities.

Q I am curious about the Black Mesa Mine that you just gave us. Isn't this the place where now there is a large operating electrified unit train?

A Yes. The mine also supplies the Navajo Generating Station up near Lake Powell and that is a separate project. It has a separate railroad that carries coal eighty miles.

Q This is an electrified rail?

A Yes.

Q Are you familiar with the experience in that project?

A Yes, unfortunately, I am.

Q Tell me why it is unfortunate and tell me why.

A It has only been in operation for a few years and it looks like they are going to have to build the whole thing over to make it work.

Q Why is that?

A The railroads are not designed for continuous heavy loading of big coal cars day in and day out. As a matter of fact, when you look down ten or fifteen years, all the coal you may transport from Wyoming and Montana to other states, you probably have to rebuild the railroads right across the country.

I got that from the horse's mouth, from the railroad people themselves.

Q Which ones?

A The Birmington Northern, in this case.

Q Who?

A I don't remember the name, but I can give you the location. I participate in a, what you call it, a conference at Washington State College south of Spokane.

Q In Pullman?

A Pullman, yes, last fall, probably October. And I participated in a panel where we discussed the transportation of coal by rail, barge and pipeline versus transmission transportation and the representatives from the Birmington Northern talked about coal hauling.

He made the statement eventually we will have to rebuild all the railroad tracks across the country. We have had this experience, unfortunately, to the Navajo Railroad.

Q That is a Tucson Gas and Electric project?

A We have a small percentage of the project. The Salt River Project is the project manager of that particular plant.

Q When you say we unfortunately will have the problem, you mean Tucson Gas and Electric?

A Yes, yes.

Q Now, taking a look at the question of the maximum operating voltage over the proposed transmission lines from the Colstrip units three and four, I believe the testimony from Mr. Zobel was that the design maximum was five hundred and eighty-eight kV, but you can go up to six hundred if necessary.

Does that comport with your understanding?

A No, I don't know what limitations would be controlling. But there would be an equipment limitation that wouldn't let you go above five fifty.

Q Ever?

A Well, I should hope not, you know. More circuit breakers and other equipment is wasted on five fifty as being the highest voltage.

Q What happens if you go to five eighty-eight?

A I don't plan to go to five eighty-eight.

Q What you do, you burn things out?

A Well, yes. Conceivably it could, yes. You wouldn't necessarily do so. A lot of two thirty kV equipment is operated at two fifty kV, a lot of three forty-five kV equipment is operated at three sixty-five, and so that is a proximal matter.

I think five fifty would be the highest operating level that you would want to have there, now, talking at an operating level.

Q Now, the normal kilowatt voltage is five twenty-five; high load five fifty, low load five twenty-five?

A Yes.

Q You have a plus or minus of ten percent on a five twenty-five nominal line?

A No, a plus or minus five percent. It is ten percent on five hundred, but it's plus or minus five percent on five twenty-five. You could go out and buy equipment with plus or minus ten percent, but that would probably carry a premium of some sort.

Q Do you know whether the Montana Power Company has discussed with you the advisability of an environmental monitoring program?

A For the power plant or transmission

lines?

Q Both.

A No, I don't recall that we ever did. I believe they had a monitoring program around the power plant site, which is reasonable for determining their particular matters and such as that.

Q Such programs were conducted by Tucson Gas and Electric Company, were they not?

A Most of the power plants have programs of this kind, yes.

Q What are the greatest benefits in having such a monitoring program?

A Well, it allows you to more accurately determine what contribution, if any, is caused by the power plant.

Q Do you know what experience by the Tucson Gas and Electric Company has had with monitoring programs that is substantial but not necessarily quantified in dollars?

A That is a good question. I am not sure I quite understand your question. We have had some substantial monitoring programs.

Q On June 15th, 1973 the Westinghouse Environmental System Program wrote to John Evans requesting him to consider using the program and see if the benefits of the program performed by

Tucson Gas and Electric Company cannot be easily quantified in dollars, but they were substantial, you might discuss this with Jack Votkyo.

A I am not familiar with this particular program, but this must be pertaining to some sort of monitoring along the route, but that is much too little money for that, we have one at the Navajo Plant that costs almost two million dollars.

Q Okay. Now, with respect to the Environmental Impact Statement issued by the Department of Natural Resources and Conservation on the Colstrip Project units three and four, Mr. Greve, the C. T. Main Company was asked to make comments on, particularly Volumes One and Four of the Environmental Impact Statement.

Did you personally make substantative decisions as to what those comments would be?

A I do not remember. I seem to remember there were some preliminary drafts.

Q I know that Gene Zobel and Chuck Taylor prepared their comments, sent them to you, you sent comments to John Evans. And I want to know whether you, yourself, made any substantial comments.

A I do not recall at this time. I would have to sift through them and see where they came from.

Q Did you personally review with care the draft of the Environmental Impact Statement of the Department of Natural Resources?

A I reviewed one of the volumes fairly carefully, I believe one that deals with transmission.

Q That is Volume Four.

A That is the one I reviewed in detail. Of course, most of the information in Volume One were repeats from Volume Four. So I don't think there was any difference.

Q Volume One is a summary of Volume Two?

A Yes.

Q After having done that, carefully reviewed it, you don't recall having formed any conclusion as to what you reviewed?

A My comments, if any, were included with the total comments that went to John Evans. I think most of the comments came from Gene Zobel's group.

Q If there had been any editorial revisions of the comments submitted to you from Gene Zobel or Chuck Taylor, would you have made those revisions?

A I might have or Chuck Taylor might have.

Q Aside from Taylor or Zobel, anyone besides you who would have been in on the editing of the proposed comments?

A I think not, but I am not sure.

Q In Exhibit 9 marked with your deposition, a letter of January 22, 1975 from John Evans to you, which notifies you of units in service dates for the Colstrip progress report, that is to Western States Coordinating Council. Do you recall receiving this letter?

A I don't recall receiving the letter. I notice from the date that this is when I was, essentially had resigned from Charles T. Main and no longer actively involved in the work. I informed Mr. Evans by letter in late December that Mr. Taylor would be the project manager starting January 1st.

Q Right.

A And I would assume that all correspondence coming into, addressed to me would automatically go to him. I don't think I have seen this letter before.

Q Okay. The report that would be made to the WSCC would have been a factual and reliable report, would it not?

A Oh, yes. This is a matter of informing the neighbor companies what each company is doing, and I remember now that Mr. Evans had asked me, oh, about November or December, to prepare this report for them because they were running short of manpower, it was overdue.

Q Now, that report to the WSCC would be the kind of report that the other participants in the WSCC would rely upon in making their own plans and projections, isn't that true?

A That is correct.

Q Now, if by January 22 of 1975 in fact the unit in service date for unit number three was not July of 1978 but November of 1979, would that have been an important factor to have changed?

A No, not really.

Q Why not?

A This is far enough in the future so I think that a neighboring company could recognize that it could come in '78 or come in '79. As an example, the Tucson Gas and Electric has a unit in construction and due for operations in May, 1978, I believe at this time that it probably wouldn't make it that year, but it happens to fit very well the way our loading is going, and we will take it in '79 when it comes to within a year, one way or the other. I don't think it would affect the neighboring companies. The main thing we need to know is what the plans are, and of course, as new development comes along when they will be implemented.

Q The companies, of course, are all in the same business of load forecasting, developing resources, they understand problems of delay from whatever reason, don't they?

A I think that is correct.

Q And so when they see a July, 1978 date and they pretty much say to themselves it could, but it could also be a year or two later, don't they?

A I might be inclined to make that conclusion, yes.

Q Well, you, for an example, have some concern now with Tucson Gas and Electric to make sure there are loads available, resources available to meet loads. You draw those kinds of conclusions when you see the report from the WSCC?

A If they affect us, if they affect us I might go and inquire a little more closely, but going in and really making this -- for an example, we have a neighbor to the south that has a unit coming in in '78, and their connections are exclusively on our system, and they think they are going to get it in in '78, but I am assuming that they aren't going to get it in, and I am planning accordingly.

The main thing is to be informed of the activities rather than, you know, precisely just when.

Q And to a greater extent that you are affected by the potential plans of your neighbors, you will make appropriate inquiries to satisfy yourself on how reliable their plans and expectations are?

A I think that is correct.

Q Now, as you originally planned to do the job, there was some hope, was there not, a certificate might issue so that units three and four were approved within very short order like in the spring of '74?

A The spring of '74 was the hope for the date of certificate, yes.

Q But as you drew closer to the spring of '74, there was greater pessimism that that date would be met?

A It kept moving down the road, yes.

Q Nevertheless, it was still your thought and your recommendation to your client that some of the materials should be placed on an order even if a permit hadn't been received, because otherwise you couldn't complete the line as was being forecasted for scheduling; isn't that true?

A That is correct. There was one other reason. We had some very favorable quotes on some material, I would hate like heck to give that up because you pay for it the next time around.

Q It is true,is it not, that the material in fact was not ordered?

A I believe the materials -- okay. We had until approximately this time on many items to decide whether to take delivery as scheduled or to postpone it, and I am assuming that in the course of this spring, various decisions had been made on whether to take delivery or not to take delivery of the various items involved.

I don't have any knowledge of the decision that was made.

Q By the time you left, delivery had not been made; is that correct?

A No, but by the time I left, the schedule for delivery was in accordance with the completion date in '78. It would require an action from the power company to say to the supplier any decisions which were pinned down on the order date, delay this delivery, say, six months or twelve months.

Q If the delivery dates are not set now or within the next thirty days, it would be impossible to meet that original schedule, wouldn't it?

A It will be very difficult. I hate to say anything is impossible.

Q Anything is possible.

A But it would be a costly delay. In fact, I so informed our client in November or December, and now it looks like we have slipped. The principal key item there was to conduct aerial photography on the transmission line route before the winter came, if we didn't know where the route was. This means we would have to wait until this summer and from there everything else goes down the road six months to eight months, maybe a whole year.

Q It remained your understanding until you left C. T. Main that any start of work on the transmission lines had to be contingent upon the issuance of the certificate from the Board of Natural Resources; isn't that correct?

A Yes, that's correct.

Q And there were certain cancellation clauses to allow for such a contingency?

A Yes. I believe we had that in most contracts. In some cases, you pay a penalty, of course, but that was included.

Q Now, why did you tell Mr.Zobel in April of 1974 that he shouldn't mention a five hundred and twenty-five kV, that that study should talk about it at the five hundred kV line?

A There was a lot of confusion on the part, if you pardon the expression, all the lawyers involved as to the difference between a five hundred kV, five twenty-five and five fifty kV. As far as engineers are concerned, this is all the same thing. Five hundred is a nominal designation, five twenty-five is the operating level, maybe five fifty is the maximum level. But I do believe that there was one or several reports that had picked the number five hundred, and there was some concern on the part of, at least one lawyer, that you raised questions by mixing these numbers, so we just tried to be consistent.

Q Did you know that Westinghouse was preparing an environmental analysis that assumed it was a nominal five hundred kV line with a maximum of five twenty-five?

A I knew that Westinghouse prepared the environmental analysis; whether it was a nominal five hundred or five twenty-five, I didn't know what assumptions they had made.

However, the Bonaville Power System in the past did have those limitations, and it was a relatively recent decision to raise the operating level based on experience to make it five twenty-five, and then designed for a maximum of five fifty.

Q It doesn't make any difference to you whether the environmental analysis was done on the assumption of five hundred with a maximum of five twenty-five or five fifty?

A I don't believe that is significant, no.

Q Would you agree, Mr. Greve, that on the subject of audible noise from transmission lines, the dividing lines by acceptable and unacceptable noise levels cannot be defined with accuracy?

A It sounds like a reasonable statement, yes.

Q Because of the altitude at which the transmission lines were operating in the Colstrip Project, you would anticipate, would you not, that audible noise could become very annoying?

A I don't know offhand what effect the altitude has on it. I would be more concerned about the lack of background noise.

Q You see this letter of July 24, 1973 that you wrote to Mr. Evans, you wrote to Mr. Evans?

A Yes.

Q On the third page, in the second paragraph --

A Okay.

Q -- in the second sentence, you say "Due to the altitude of the line --" is that attitude or altitude? I think it's altitude.

A It depends on various things, and population density. However, due to the altitude of the line, the audible noise level could become very annoying. This might have been based on the data I have available, at that time, yes, but of course you have more emissions, but I don't know how much.

By the same token, we don't really know what level is annoying.

Q Well, Bonaville has kind of a general guideline they use with fifty-nine decibels above, you get complaints between fifty-two and fifty-nine, and up to fifty-two decibels, no complaints?

A Right.

Q I suppose the number of complaints has something to do with, I assume, the annoyances?

A Yes,I think so. I think you design the line for below fifty decibels, and that was the result of the large conductor being used for other reasons.

Q The mallard?

A Yes.

Q I think you told Mr. Graybill Mr. Nesgos had worked on the Ontario Hydro for a while.

A Yes.

Q Do you know Mr. Robert Nebro?

A I don't believe I do. The name sounds familiar, but I do not believe I know him.

Q Is it true with respect to the corona losses that they are primarily affected by voltage gradients and precipitation, true?

A And altitude.

Q Generally speaking, fair weather corona losses are quite small, and usually ignored in calculations?

A We include them, but they are quite

small, yes.

Q In your calculations as to corona losses, you assumed a ninety-five percent fair weather, five percent foul weather?

A For the purposes of making an economic determination of the best conductor, we assumed that distribution.

Q Now, if that assumption was wrong, how would that have affected your calculations?

A Well, let's assume you had more foul weather, then you would have greater corona losses, we would favor a larger conductor.

Q Now, in order to minimize the corona losses?

A Yes, but here again, as I mentioned before, the optimum conductor selection is a relatively flat minimum, and the error there would be -- is not sensitive to small variations.

Q Was it your belief, Mr. Greve, that the construction guidelines proposed by the Westinghouse Environmental System Division in their environmental analysis committed the Colstrip Project management and whoever were to construct the transmission line, to needless details in specific procedures?

A I don't -- if I ever used those words, they sound a little strong, but --

Q It doesn't sound like your style?

A It doesn't sound like it. There were a lot of details in there at one time, I think by and large they came out reasonably well in their reports.

Q Do you know if Mr. Evans had a feeling that the specific procedures had been needlessly detailed?

A Well, I think he is entitled to that opinion because I had not been exposed to selling all these things out before. That doesn't mean that the construction crew didn't consider them, but spelling it out all in detail was new to him, I think.

Q You didn't see anything wrong with the need for the details?

A There were some places where I might consider it excessive, but generally speaking that is just on paper and the important thing is to make sure that the construction crews really get this information.

You can write reports all you want to.

Q Of course, if the actual supervision of the construction crews do not result in their getting the information, then it would be a coming in in '78, and their connections are exclusively on our system, and they think they are going to get it in in '78, but I am assuming that they aren't going to get it in, and I am planning accordingly.

The main thing is to be informed of the activities rather than, you know, precisely just when.

Q And to a greater extent that you are affected by the potential plans of your neighbors, you will make appropriate inquiries to satisfy yourself on how reliable their plans and expectations are?

A I think that is correct.

Q Now, as you originally planned to do the job, there was some hope, was there not, a certificate might issue so that units three and four were approved within very short order like in the spring of '74?

A The spring of '74 was the hope for the date of certificate, yes.

Q But as you drew closer to the spring of '74, there was greater pessimism that that date would be met?

A It kept moving down the road, yes.

Q Nevertheless, it was still your thought irrigation pipes might be handled under your lines?

A Yes. This was one of the reasons for the increased clearance above that which is required under the National Electrical Safety Code.

Q Up to thirty-five feet?

A I don't recall what the Code requires, but it is much less than thirty-seven feet that we felt was desirable.

We tried to combine several requirements and come up with a clearance that would give us a sound clearance for a number of things, and one of the considerations was a farmer under the line handling length of irrigation pipe.

Q At some point in 1973, Mr. Greve, while you were pushing for entering into the contract with the various suppliers, least you lose the favorable prices that were available, you made reference to a delay of seven weeks which could be very costly and crucial. Why seven weeks?

A It sounds very small at this time, but at that time it must have been important. Could you refresh my memory?

Q Sure. Take a look at this teletype

mail gram, I suppose you sent to Mr. Evans on November 27th, 1973.

A We had bids from various steel suppliers, one of these suppliers was a foreign supplier and the foreign supplier could not begin to deliver the materials until, I presume, seven weeks after the in-country supplier. At that time, we felt that in order to make the date we were shooting for, we had no time to lose and we were concerned about going to a foreign supplier, number one, because of the longer delivery time but perhaps more importantly, I don't know if it says so in that letter, the possibility that you might have strikes or shipping interruptions or problems that were, you know, completely beyond control.

Also as I recall, the total price differential, if there was one, was not all that significant.

Q The foreign supplier was from Italy?

A Yes.

Q From the beginning of the project, you were on the time-was-of-the-essence-basis in order to meet your schedule, weren't you?

A Yes.

Q Therefore, a delay of seven weeks as

originally conceived could have been critical to transmitting power?

A Well, I think that is right, you know. I mean, if the power plant was ready to go and could not get the power out, then it is important, naturally.

It would appear that we perhaps were too optimistic at that time.

Q By that you mean you just couldn't make it?

A Well, it's quite clear, you know, that we can't make the time frame as originally planned.

Q Sure.

A However, as affects the line for units one and two, I think we have a good chance to meet that time frame if they get the right-of-way cleared up there.

Q Now, I have been asking you questions as has Mr. Graybill today, Mr. Greve, based upon documents which we obtained from the C. T. Main office. I think we advised you we previously have taken the depositions of Chuck Taylor, Bob Anderson and Gene Zobel of the C. T. Main Company, and I have a few questions to ask you from their depositions where they referred items to you, in effect, and I think we covered some of them already.

Do you know why Mr. Taylor would have had some discussions with the folks at the Colstrip Project Management on the addition of units five, six and seven in connection with theories compensation questions?

A No.

Q In any event, you have not?

A It doesn't ring a bell at all, no. Is that recent?

Q He didn't say how recently, I don't think. It looks like it was recent, it was at a time when you were trying to decide how much room to leave in the event those units would go in.

A Here again, Main is not designing the station at Colstrip, but --

Q It looks like the Broadview station is probably what he is talking about.

A Well, now, that is a different matter. You almost always design a station to provide for something sometime in the future so that you aren't locked in.

Q You still don't recall those discussions?

A I don't recall anything specific about five, six and seven,no. As far as providing room for possible future lines, that is something you always should do, and you might sit down and philosophize as to where it might come from, north, south, east or west, this sort of thing.

Q When the Montana Utilities Siting Act was ennacted, you had been on the job for the Colstrip Project only a few months?

A We started this assignment on the 8th of January, 1973.

Q And the Utilities Siting Act came a few months later than that.

A The end of March, I believe.

Q When the Utilities Siting Act was ennacted, you then knew there was great difficulty in meeting the original schedule for units three and four, didn't you?

A Not immediately. It took considerable time to find out just what the Act said and there were no clear guidelines, really, as to what the requirements would be that had to be met.

Most of the efforts in '73 in terms of preparing the Environmental Impact Statement were directed towards meeting the Federal requirements, because we knew that we were going to cross the Federal land.

Q This question was asked of Mr. Taylor on deposition March 21st, 1975, page forty-eight, as soon as that bill, referring to the Montana Utilities Siting Act, was ennacted you had, C. T. Main knew there would be some very great difficulty in meeting the original schedule on the Colstrip Unit Three and Four in 1978 and '79, respectively, did you not?

Answer: "yes." You would not disagree with that, would you?

A Yes, I think I disagree from the point of view I don't think we knew it right away. It was a gradual, something we learned gradually.

Q Within a few months or so, your gradual realization concluded, I take it?

A But we still expected to get a license in early '74. It was for a long time the understanding of the power company that the department would bend over backwards and get a license out in the spring of '74. Maybe that was also too optimistic.

Q Did you ever personally meet with anybody from the Department of Natural Resources?

A Yes, there were a couple of meetings in Helena, and a few in the power company's offices. That was probably a good deal later.

Q What were the subjects of discussion at those meetings?

A I don't recall exactly. Let me think. I believe there was one meeting where the department personnel asked questions about alternative transmission plans, but I don't recall the details. They asked questions about the computer programs that the power company used in analyzing the power system, and a few things like that.

Q Would you agree, Mr. Greve, that the concensus for the Colstrip transmission lines was to overdesign, meaning to have the system so it could operate on overloaded conditions?

A No, I don't think so. I think the design is geared to meeting the loading from the initial four units.

Q Would such questions as design and overloading be something within the system analysis?

A Yes,I think so.

Q That would be under Nesgos' responsibilities?

A Yes, basically. It depends a little bit on what you mean by overloading. We might talk in terms of loss of a line and temporary overloading of the remaining line, for an example.

Q And you would agree, would you not, Mr. Greve, that the system can be designed to meet acceptable environmental effect levels for transmission lines?

A Yes, I think so.

Q When you first began work on the project, Mr. Greve, do you recall having been informed by the client that information on the plan for building units three and four was supposed to be kept confidential until units one and two were certified?

A I don't recall that exactly that way. I do recall -- let me think -- I cannot recall anything like that.

I do recall there was a discussion that they didn't want to have a publicity release from Main until the companies were prepared to give one out on their own.

That is a normal requirement from many clients.

Q Was it your understanding as many guyed structures as possible would be used for the transmission lines?

A That is definitely the intent of the design, the guyed structures, we believe, are more economical by several percent.

Q And therefore, you would like to have seventy-five to eighty percent of the structures guyed?

A Well, we assume that we could get that many guyed structures in.

Q Since you were not at the meeting on February 6th and 7th, 1975 at Main's Charlotte office, you would not have heard the instructions of Mr. Evans that the folks at Main should not use a per-mile cost of anything in excess of one hundred fifty-two thousand dollars, I should say per kilowatt-mile cost?

A No, per-miles-of-cost-of-line.

Q Per-mile cost of the transmission line?

A Yes.

Q Yes. Had you ever received such instructions from Mr. Evans prior to that time?

A No. Basically we have provided him with cost data on the line and, of course, as the various bids came in, the costs would be updated.

We always tried to stay on top of escalation and construction costs, which were shooting up very badly into '73 and in '74, and I would interpret the number you gave me there as being the number that was in effect at that time when this report went in or something like that.

Q What report?

A Well, let me think, now. The environmental report went in when?

Q The Westinghouse?

A Yes.

Q November, 1973.

A I don't think we were that high. Let me think for a moment.

I remember a number you have there, it's our estimate based on the latest construction costs plus the overhead incurred by the power company for their participation in this and so forth, and I guess that would be, that would be December, last year.

So rather than, you know, costs are going up until you actually let the bid, I would say as an instruction as to this number, we gave them as so-and-so times, don't fog the water up by changing it a little bit.

Q Why not?

A No particular reason. I can't imagine why, I would like to know what is the most probable cost we are going to pay out, we pay out the money.

Q And if the escalation in fact occurred, you should know that?

A I think we updated the estimate.

Q Do you recall a difference of opinion with people between the costs from Westinghouse and C. T. Main, what would be the best corridor?

A Not specifically. Main selected four corridors, and Westinghouse selected from that portion, too, I believe, and tied them together and made the so-called preferred route.

In my opinion, that was a good route. I had in preparation the proposal on the project in the fall of '72, and conceptually identified a route that was very close to what we came up with. But I had nothing to do with the selection on the route. I understand there was some discussion whether to go north or south of the lake there by Helena -- what is the name of the lake, you know, not Big --

Q Canyon Ferry?

A Yes, Canyon Ferry. Some people felt it was better to go north and some felt it was better to go south, but this was a subjective evaluation, very difficult to tell.

Q Early on in the project, it did become clear to you, did it not, as a result of at least a preliminary investigation there were going to have to be a number of tests conducted which were far more extensive than originally anticipated?

A You mean system tests?

Q Yes, sir.

A Yes, sir, definitely. One of the reasons for that was the changing space input data from adjoining power companies, as I mentioned earlier. We had two sets of data from Bonaville with different representations of the system, and when we checked this out, we eventually came up with a third representation.

Q When you knew that you had to do more extensive tests at that point, you knew that this schedule which was already tight was going to be very difficult to meet, didn't you?

A No, the system tests in no way delayed the project schedule. We had other critical items, probably the most critical was the procurement of steel.

Q Do you know why eventually a hold would have been placed on the substation design study except those directly associated with the hearings in the offing for the Colstrip units three and four?

A I can only assume that -- okay. The design of the two thirty kV facility, I believe, is primarily completed. The design that is remaining involving the five hundred kV portion of the substations, it sounds as though nobody is willing to spend any money to continue that design until they know whether or not it is going to go ahead on the project.

But the time for completion is probably not critical.

Q The last question I want to ask you, Mr. Greve, back to the question of the tower testing: you knew, did you not, that Mr. Evans of the Montana Power, the project coordinator, was concerned with the continuing failures of the towers being tested and that he had good reason for being concerned?

A Yes.

Q Why was that?

A Because if the tower test didn't get completed, we would fall behind in getting the steel towers manufactured in time for delivery to the contractors so we could get the facilities built. We were, the tower testing had been estimated to take a certain amount of time. It took much longer and we were beginning to eat into the manufacturing time for the steel towers.

Q Just for the record,I think Mr. Graybill referred this morning to a memorandum to you from

Mr. Zobel of May 7th, 1973, included some design memorandum. We should note that was Exhibit 16 to Mr. Zobel's deposition.

Do you recall having requested Mr. Evans an opportunity to insert some specific construction guidelines for the transmission lines?

A I don't recall it,no.

Q As a part of the text in the specifications, showing you Mr. Zobel's Exhibit Number 17?

A This was included in the construction.

Q Specifications?

A Yes, but it was abstracted from the environmental report, as I recall it.

Q That is where you believe you obtained that?

A Yes, I think so. You will notice here that what Mr. Zobel is saying, this is abstracted from the environmental report which was written by Westinghouse; since it was under their authorship, he asked Mr. Evans' approval to abstract these guidelines and include them in the instructions to the contractor who would build the line.

MR. SHENKER: Okay. Thank you, sir, I have no further questions.

RE-EXAMINATION

BY MR. GRAYBILL:

Q   I have only three or four little areas.

I am aware of your talking with Mr. Shenker about the coal pipeline and about the railroads.

Did the Main company conduct any studies as to the shipment of coal to the load centers? Did you make any cost estimates or anything of that nature?

A   Not from Montana Power Company.

Q   Not on this project?

A   No, not on this project.

Q   Secondly, are you familiar with the fact that promises were made to farmers in the Broadview-Forsythe areas that self-supporting structures would be suitable for cultivated land?

A   Yes.

Q   Is it your understanding that for uncultivated land the guyed structures are not going to be built?

A   If the farmer doesn't want it there, we will put in self-supporting structures.

Q   So it depends on the farmers asking for this?

A Yes, it's up to the landowners. Now, on the other hand, I do believe that the land acquisition people of the power company has made this promise outright; that is essentially the information we get or Main gets is that here is the cultivated land, put in so-and-so towers.

Q But you understand, your instructions are that if the farmers want free-standing towers he can have them on cultivated land?

A Yes.

Q Just to clear up this one small point this morning, I show you the progress report, I am sure I showed you the progress report for January 1st to the 31st, 1974, calling particular attention to the paragraph there which does relate that the recording or reporting equipment on one of the ice devices, testing devices, was disconnected for a period of time during the winter of 1973-74; right?

A Yes, I think I remember that.

Q And according to this, it would be the month of probably, in the month of November?

A Yes.

Q Right. This recording device was disconnected, and we don't know for how long.

A Well, it would have been at least a

month, they are attended every month.

Q During the month, however, of November?

A I think they were probably attended approximately in the middle of the month, they had a schedule which they ran on them.

Q So we don't really know what the ice conditions were at Site Four between mid-October and mid-November; right?

A That's correct.

Q Why did you leave C. T. Main and go with the Tucson Gas and Electric?

A Well, a number of reasons were involved, but I think the principal one is that I felt it was a tremendous challenge here, it came out of the blue, I had never given any thought to leaving Main, I was there for twenty-three years, this company has had some severe difficulties in the past couple of years.

Q Did you have any difficulty with the Main Company, you, yourself, or with any of its personnel?

A In Charles T. Main?

Q Yes.

A I don't believe so.

Q Did you have any problems or difficulties with the applicants in this case, the five power companies or any of their personnel?

A No, none whatsoever.

Q None of these things had anything to do with your leaving?

A No, none whatsoever. Just by happenstance, I got in the mail the other day the resolution passed by the Board of Directors of Charles T. Main, which was complimentary, I don't know for what reason they passed it, but it could probably be made available to you.

Q I don't think I have any question of your ability, Mr. Greve.

Is there any problem or do you have any knowledge of any situation in connection with the project we have been discussing here today which causes you to now want to be deposed in this case?

A No, strictly that matter of, number one, feeling that I have crucial things hanging down here; number two, my opinion is that others could have answered all these questions equally as well.

Q You have no knowledge of anything wrong or bad or incorrect that you don't want to disclose to us?

A No. On the contrary, I think you have a good project here, I expect that it will be built eventually, although it may incur some delays.

Q Well, of course, you are in the realm of being analytical and maybe philosophical and maybe we had better stop.

EXAMINATION

BY MR. ROSS:

Q Mr. Greve, have the applicants or any of their representatives ever indicated to you that we would build any plants beyond three and four in the Colstrip area?

A No. As I mentioned at at least one point in the testimony, I thought that somewhere I had seen or heard a discussion of a coal-gasification plant in that region, but I don't believe that came from any of the applicants.

I think it was mentioned in a newspaper and if generation were developed for it, it would not affect the transmission system, so I never dealt with anything but the four units on the transmission system.

MR. ROSS: That is all.

(End of deposition.)

EINAR GREVE

STATE OF ARIZONA)
) ss:
COUNTY OF PIMA   )

BE IT KNOWN that I, Roy M. Profitt, II, took the foregoing deposition pursuant to notice at the time and place stated in the caption hereto; that I was then and there a Notary Public in and for the County of Pima, State of Arizona; that by virtue thereof I was authorized to administer an oath; that the witness, EINAR GREVE, before testifying was first duly sworn to state the truth, the whole truth and nothing but the truth; that the testimony of said witness was reduced to writing under my direction; and that the foregoing 173 pages contain a full, true and accurate transcription of my notes of said deposition.

I FURTHER CERTIFY that I am not of counsel nor attorney for either or any of the parties to said cause or otherwise interested in the event thereof; and that I am not related to either or any of the parties to said action.

IN WITNESS WHEREOF, I have hereunto subscribed my name and affixed my seal of office this 14th day of January, 1976.

NOTARY PUBLIC

My Commission Expires:
June 19, 1978

LAWYER'S NOTES

Page	Line	

LAWYER'S NOTES

Page	Line	

14.1.3

MAIN
Engineers

CHAS. T. MAIN, INC.
1800 S. W. FIRST AVENUE, PORTLAND, OREGON 97201 • TELEPHONE 503-222-4227

May 31, 1974

Mr. J. T. Evans
Project Coordinator
Montana Power Company
40 East Broadway
Butte, Montana 59701

Dear Mr. Evans:

Reference is made to letter dated May 14, 1974, from the Bureau of Land Management, U. S. Department of the Interior, addressed to Mr. C. R. Anderson, Manager Montana Power Company Environmental Department. We have reviewed the letter in accordance with your request during your recent visit to Portland, and suggest the following as part of your reply to the various questions asked. The following numbered replies correspond to the numbered paragraphs in the BLM letter.

1. We plan an initial installation of two three-phase 500/230 kV transformers at Broadview, rated 300/400/500 MVA. In this arrangement, the forced OA rating will provide reserve capacity during outage of one unit. This transformer capacity should be adequate for approximately 10 years. In the early-mid 1980's, additional transformer capacity will be required for the system, and we would then propose a similar installation at Helena, again with two three-phase transformers of the same rating. A third unit may be added at either or both stations in the late 1980's.

   why?

   With the 230 kV system assuming the subtransmission role, we do not contemplate additional 500 kV stations before 1990. Of course, this does not rule out additional stations in the future.

   The Helena and Broadview stations are required in the initial system as switching stations in order to maintain system stability during outages of transmission lines. Without these stations, too much line could be lost to one fault occurrence, resulting in an unstable

EXHIBIT 11
DATE ____ DEPOSITION
Roy M. Profitt - COURT REPORTER

system. Therefore, the Broadview and Helena locations are both electrical and physical constraints on the transmission line location. Some leeway exists, however, in that both stations could be moved some distance north or south along the underlying transmission circuits without changing the system characteristics.

2. It is electrically feasible to route the 500 kV circuits through Anaconda and west through the McGruder Corridor. A better electrical arrangement would be to have one line through the McGruder Corridor and the second line from Anaconda to Hot Springs. We understand that this solution was rejected because it was not considered feasible to obtain right-of-way through the McGruder Corridor within the time frame of this project.

3. If bulk power from Colstrip was routed through Wyoming and southern Idaho to the Pacific Northwest, there would be an initial requirements for two additional 230 kV circuits from Colstrip to the Billings area and one 230 kV circuit from Billings to Anaconda. This assumes that the Billings-Great Falls circuit will be in service in 1974. During the 1980's, additional 230 kV circuits would be required. Tentatively, two additional 230 kV circuits would be required from Colstrip to Billings, one in the early 1980's and one later on. Also, additional 230 kV circuits would be required from the Billings area to Great Falls and from the Billings area to Anaconda. It should be noted that existing, as well as planned transmission facilities from southern Idaho to Oregon would not have spare capacity to carry the Colstrip power to the West Coast.

4. The proposed 500 kV lines do not replace the existing 230 kV system in any way. The 500 kV transmission lines represent an expressway for bulk power delivery to the Montana system and points west, and the existing and planned 230 kV system will be required for distribution of this power within Montana.

5. By the mid-1980's, Montana Power Company will require additional capacity to meet expected load growth. This capacity could be obtained by contracting for portions of planned nuclear facilities in Oregon or Washington. While this remote capacity would be owned by Montana Power Company, the electricity produced recognizes no ownership. Therefore, increasing amounts of power

produced at Colstrip would flow to the nearest load, i.e. the load of the Montana Power Company. Thus, power produced at Colstrip would be displaced by power produced elsewhere.

At the present time, power deliveries from the state of Washington are flowing into Montana. During the initial years of the Colstrip project, this power will flow to other loads and be displaced by power produced from the Colstrip project. This makes it possible to build minimum transmission facilities as proposed for this project.

We hope the above will assist you in preparing a reply to the Bureau of Land Management. We will forward additional comments regarding the use of a slurry pipeline for coal transportation within approximately a week's time.

Very truly yours,

CHAS. T. MAIN, INC.

Einar Greve

EG:df

cc - Proj. Pers.

1.1.1.4G

MPC
SERVING YOU IS OUR BUSINESS

THE MONTANA POWER COMPANY
GENERAL OFFICES: 40 EAST BROADWAY, BUTTE, MONTANA 59701 · TELEPHONE 406/723-5421

January 22, 1975

Mr. Einar Greve
Chas. T. Main, Inc.
1800 S.W. 1st Avenue
Portland, OR 97201

Dear Einar:

This letter will supersede our letter of January 21; the change is in Unit 1 service date.

1. This is to notify you that the unit in service dates to be used in the Colstrip Project Progress Report for WSCC are:

Unit 1	October 1975
Unit 2	July 1976
Unit 3	July 1978
Unit 4	July 1979

2. Studies relating to Units 3 and 4, including, but not limited to, the subsynchronous resonance study and the transient network analyzer study, are to be delayed until after we have received approval from the Board of Natural Resources and the Bureau of Land Management for Units 3 and 4 (with transmission). With the certainty that an appeal will be filed, regardless of which way the Board decides initially, it may be the fall of 1975 before a final "go-ahead" is reached.

3. After approval has been received for Units 3 & 4 and transmission, we desire to have the following study made concerning a braking resistor at Colstrip:

   a) Can a braking resistor be applied at Colstrip with reduced series compensation in the 500 kV system to produce a system no less stable with no brake and 35% comp?

   b) What is the optimum size of the resistor?

   c) What is the best connection at Colstrip for the brake?

DATE ______ EXHIBIT 9
______ DEPOSITION GREVE
[illegible] - COURT REPORTER

d) What is the optimum switching arrangement and timing for the control of a brake?

e) Make an economic comparison of a cast iron grid brake vs. a design similar to the BPA brake at Chief Joe hydro plant.

f) If a brake technically can be used in lieu of some or all series compensation, make an economic comparison of the brake vs. capacitors displaced.

Sincerely,

John T Evans

John T. Evans
Project Coordinator

cc: R. A. Hofacker
P. H. Beagles

JTE/by/2/1

MAIN
CHAS. T. MAIN, INC.
Engineers

Rate

OFFICE MEMORANDUM

TO: E. Greve

DATE: 9/20/73

FROM: G. Nesgos

FILE: 0503-23

SUBJECT: Breakdown Mill Rate
Montana Transmission

Referring to Table 1 of the July 24, 1973 Memo, it is seen that the additional cost of 636 mcm v/s 556 mcm is $4,630.00/unit. The pw of savings in losses by using 636 mcm is computed to be $1,600.00/unit (2 mills, 750 MW equivalent load, 10% cost of money, 50 year evaluation).

In order for the savings to equal the additional capital cost, losses must be evaluated at:

$$\frac{4.63}{1.55} \times 20 = 6.0 \text{ mills}$$

The levelized mill rate for Colstrip energy, assuming fuel escalation, is 3.3 mills at the Colstrip bus. Assuming 4% losses, value at Hotsprings would be about 3.5 mills.

A base case load flow - no series compensation showed that the total I^2R losses in the Colstrip-Hotsprings transmission built with 4-556 mcm is about 72 MW Power leaving Colstrip 500 kV bus is 1,739 MW; Power delivery to Billings area is 330 MW and 1,332 MW is delivery at Hotsprings.

G. Nesgos

cc: J. Clifford
G. Zobel

EXHIBIT 3
DATE ____ DEPOSITION GREVE
Roy M. Profitt - COURT REPORTER

W. M. HALL
G. R. RICH
W. J. LESSARD
C. A. DAUBER
WM. BAUMRUCKER

MAIN
CHAS. T. MAIN, INC.
Engineers

1301 EAST MOREHEAD STREET, CHARLOTTE, NORTH CAROLINA 28204 • Telephone 704-372-6420
Home Office: Southeast Tower, Prudential Center, Boston, Massachusetts 02199 • Telephone 617-262-3200

June 22, 1973
A503-2323

Subject: Montana 525 KV Transmission Line
Colstrip Project
Design Memorandum

Mr. Einar Greve
Chas. T. Main, Inc.
5505 S.E. Milwaukie Avenue
Portland, Oregon 97202

Dear Einar:

Attached is a draft of a Design Memorandum covering our proposed tower loads for the Colstrip to Billings section of line. We have begun preparation of the conceptual structure designs and the aluminum and steel material specifications. We are now ready to complete the drawings with the necessary design loads.

A thorough study has been made of the report from the meteorologist, MRI, and we have recently advised them of the approximate line location and requested comments concerning any adjustment and recommendations based on this location. (We also requested their recommendations based on a 25-year return period for storms to compare with the 50-year return period covered in their report.) The attached design memorandum summarizes our evaluation of all available data to date and indicates the loads which we propose to use. We feel it is important for the client to know at this time what is being proposed as we will be committed for the Colstrip to Billings section once we have requested proposals from the structure fabricators.

Please advise promptly if you or the client have any suggested changes or additions to what is being proposed.

Yours very truly,

CHAS. T. MAIN, INC.

By: E. S. Zobel
E. S. Zobel

ESZ/fl
enc.
cc: B. M. Zambotti
G. Nesgos
H. G. Stockwin
F. M. Fullerton
J. A. Cain

EXHIBIT 4
DATE DEPOSITION GREVE
Roy M. Profitt - COURT REPORTER

DESIGN MEMORANDUM

MONTANA 525 KV TRANSMISSION LINE COLSTRIP PROJECT

(WIND AND ICE LOADS FOR LINE STRUCTURES)

Introduction

We forwarded to you with our letter dated May 17 a copy of Meteorology Research, Inc.'s report covering their first phase, or Preliminary Meteorological Evaluation, for the Colstrip to Hot Springs 525 KV line. We recently forwarded to them a map overlay showing the flight line given to the aerial surveyors. We requested that they re-examine the data given in their summary on pages (i) and (ii), in light of the tentative line location which has been selected. We also requested that they advise what wind and ice load they would predict for a 25-year return period for storms so that this could be compared with the 50-year return period covered in their report.

Based on their evaluation of our line route, they have suggested a 1-1/2" radial ice of 0.6 gm/cc to 0.9 gm/cc density with 45 mph winds on a 50-year return period. For a 25-year return period, they recommend a 1.2" radial ice of 0.6 gm/cc to 0.8 gm/cc density with a 42 mph wind.

They have advised of additional changes in wind veolcity on bare conductors but the critical criteria for structure designs are those listed above.

Recommendations

We have been advised that the data on wind velocities is fairly reliable, whereas the data on ice accumulation and densities are based to a large degree on a statistical approach coupled with interviews with witnesses to actual storms. Actual measurements of ice accumulation is not on record and, therefore, are based mostly on estimates from visual observation. The most frequent ice storms, and the most severe, seem to be wet packed snow followed by high winds.

To design for 2" or more of radial ice with winds on the order of 60 mph would be extremely costly and we do not believe this is justified considering the fact that this represents a once-in-50-years storm and especially since this cannot be backed up by actual measurements.

We believe that the structure designs for the Colstrip to Billings sections should be investigated for the following load cases:

Case A - Heavy ice, no wind, 2" of radial ice of 0.9 gm/cc density at 0°F.

Case B - 1-1/4" of radial ice of 0.9 gm/cc density with 40 mph winds at 0°F.

Case C - 1" of radial ice of 0.0 gm/cc density with 60 mph winds at 0°F.

Case D - No ice, 50 mph winds at -40°F.

Case E - No ice, 120 mph winds at 60°F.

In addition to the above, we would design for unbalanced longitudinal loading on all wires which would simulate the loss of one adjacent tower for whatever reason. We would also design for a longitudinal pull of one phase due to ice dropping from one span with the adjacent span still loaded with ice. This loading would provide for adequate torsional strength in the tower for this type of condition which will surely occur.

Structures designed for these loads would be usable for the entire project but we anticipate that additional structures of heavier design may also be required for

MAIN
CHAS. T. MAIN, INC.
Engineers

4.2.1.1. Right of Way Acquisition

OFFICE MEMORANDUM

RECEIVED
MAR 1 3 1974
CHAS. T. MAIN, INC.

TO: Einar Greve

DATE: March 11, 1974

FROM: W. A. Woolford

FILE:

SUBJECT: Montana Power Company
Job No. 503-2400

I spent the entire day March 8, at Billings, reviewing operations and status with Dale Heston, John Benson, John Stebbins, and John Cain. I came away with the impression that the right-of-way acquisition portion of the project is proceeding as well as may be expected under the circumstances. By now you have Dale Heston's report of March 1, 1974, in which he reviews the status of negotiations. It appears that substantial progress has been made toward acquisition of the eastern portions of the line for which MAIN has responsibility.

The BLM/Agri-Empire land trade was scheduled for discussion and possible resolution Friday afternoon, March 8. We should have some information on the outcome of these negotiations during the coming week. Resolution of this matter will open up several adjoining owners for final negotiations. Should it turn out that the trade cannot be consummated, I recommend that MPC proceed immediately to provide the owner with a final notice and, then, to file condemnation proceedings.

According to Heston, no contact has been made with Davidson for over five months. You will recall during our meeting on January 28, with Coldiron et al., it was agreed that MPC would accept responsibility for further negotiations with Davidson; and asserted that if he could not resolve the matter forthwith, MPC would file for condemnation. So far as I have been able to ascertain, no contact has been established between MPC and Davidson (or his attorney).

The matter of authority of MPC to bring condemnation actions relative to this project is still unresolved. Despite Coldiron's protestations to beiin favor of condemnation after minimal negotiation, no such suits have as yet been filed (to my knowledge); and UFS personnel have been enjoined from mentioning the possibility of such action during discussions with owners. A suit (presumably, a trial balloon) has been filed on the Great Falls line, and it is expected that the hearing on necessity of the line will produce a ruling by the Court relative to this factor. In the meantime, UFS personnel are seriously hampered in their attempts to apply pressure to owners in order to persuade them to sign the easement agreements.

EXHIBIT 7
DEPOSITION Greve
DATE
Roy M. Profitt - COURT REPORTER

Confusion still exists relative to an approved method for negotiating with owners along the line. Heston's original instructions the mountainous regions. We feel that the installation of mobile weather stations at an early date will give us approximately one year of exposure and should help us in determining whether in some critical locations we need to design for more extreme ice and wind combinations or perhaps to relocate some portions of the line.

We have determined that the 2" of radial ice with no wind will exceed the rated breaking strength of the Eagle conductor which has been recommended for the 4-conductor bundle from Colstrip to Billings. We are investigating the possibility of a special conductor of equivalent size using more steel in the core to eliminate this problem. An alternate to this will be to investigate the use of Teal conductors which are stronger but also slightly larger than the Eagle conductor.

We can, of course, reduce the tensions to limit the conductor load due to ice, but this will increase sags and result in taller towers and added cost. For this reason, we believe that this may be a more acceptable solution in the mountainous regions on long spans where the structure height may not have to be increased.

We expect to resolve the conductor strength problem very soon but in the meantime, we would appreciate any comments about our proposed structure loads as we are developing our designs on this basis.

Heston further stated that his requests to John Cain for information on the project have by and large either been ignored, or answers have been delayed without apparent cause. I suggested to Heston that he put his requests in writing to John, with copies of the request to you and me; and then if his request is ignored, he can repeat the request and document his original request. He was also instructed to furnish me with a copy of every easement or option instrument as it was executed, with a similar copy to go to you via John Cain. This will tend to answer Cain's complaint that he receives little or no information on right-of-way acquisition status from Heston. Heston agreed to do this.

Heston requested permission to obtain a copying machine for use in their office. He has repeatedly bemoaned that they might go down the hall to another office in order to obtain copies--that this is inconvenient and time-consuming for him as well as for the firm that is supplying the copies. I told him that we have a 3M copier in the Denver office, which is only getting minimal use at the present time and that I would investigate the feasibility of sending it to Billings for their use. The machine is quite reliable and relatively inexpensive to operate.

It appears to me that at least a portion of the problems that we were experiencing at Billings is the result of a lack of understanding on both sides relative to the aims and needs of other persons involved in the operation. Dale Heston is quite direct and apparently knows his job well (to which John Cain will testify); but he is not particularly concerned with amenities with respect to others in the office. Cain and Stebbins are both fairly hardheaded and are apparently not known for their sense of humor. Benson is quite pleasant but seems to enjoy needling Cain relative to the inclusion of the self-supporting towers on certain parcels of land. Cain, in turn, does not appreciate this; and so the circle turns. During my parting remarks to Heston, I attempted to persuade him to apply the soft pedal to Benson's relationships with Cain in an effort to improve their rapport. Heston displayed a cooperative attitude in this respect, and perhaps this situation can be improved.

I will be available for a meeting in Butte at your call during the week of March 18 or 25 (except for March 19). If you will arrange the meeting at your earliest convenience, I will draft the proposed letters, which we will then discuss, and also get anything else ready that you may suggest. I look forward to your early reply.

W. A. Woolford

WAW:sh

from Coldiron were to make not more than three calls on any owner and, then, to submit the case for condemnation. Coldiron's position now is reported to be that if Heston mentions condemnation to an owner, he (Heston) will be "fired on the spot." This is an apparent reversal of position of Coldiron's position, and we need clarification (in writing) of exactly what tack Coldiron expects us to take.

I don't see this as reversal

Wording is still needed relative to approved form letters for Heston's use in specific situations, as outlined in his memo of February 12. I would suggest that this matter be resolved in a meeting at Butte, which should include Jim Couture, Dale Heston, Bill Coldiron (?), along with you and me. With some lead time, we can have suggested copy ready for consideration at this meeting, leading to early revisions (if needed) and approval for use in operations.

Additional direction is needed relative to right-of-way activities west of Broadview. You will recall that the notes from our meeting at Butte on January 28, stated in part the following: "No further work is to be done on right-of-way acquisition west of Broadview pending completion of surveys and drilling work in that sector. This is expected to take from four to six weeks to complete." Heston reports that surveyors and drillers are expected to begin work on the western segment of the line in the near future. He and Benson recommend that a land man be assigned to work with the survey and/or drilling crews in order to be able to answer questions of landowners relative to the project and to be able to settle, on the spot, any damages that may result from the survey and/or drilling operations. This mode of operation would have the added advantage of allowing the surveyors and drillers to survey and drill rather than spending time in conversations with the landowners.

It is becoming increasingly evident that a concerted public relations program is needed in order to attempt to offset some of the adverse publicity that is being generated by NPRC, the Sierra Club, et al. Steve Charter, director of NPRC, is reported to be collecting names and addresses of landowners along the western segment of the line for the avowed purpose of organizing them against the construction of the line. Heston already has the names and addresses of the affected owners, and it would appear prudent to undertake a countering program. Action is also needed relative to public meetings. Meetings are already scheduled at Custer, Red Lodge, and Townsend during March and April. It would appear wise to schedule as many additional public meetings as possible during the next two to three months in an effort to get the MPC story to the public at the earliest possible date.

Heston reports that legal descriptions being furnished to him by Teledyne are less than acceptable. As an example he cited one property plat that had five errors. Apparently, they need some advice concerning the checking of their plats prior to sending them out.

MAIN
CHAS. T. MAIN, INC.
Engineers

OFFICE MEMORANDUM

TO: File

DATE: June 29, 1973

FROM: R. S. Wolfe

FILE: A503-2323

SUBJECT: Colstrip Project

COPY

We have received information from Pacific Power & Light Company about heavy design loads for their Jim Bridger 345KV line. At one location this line goes over a ridge (8000 ft. elev.) at which heavy ice and wind loads are expected. The conductor is to be Kiwi. Ice and wind loads are 2.2 inches radial ice with 12.3#/sq. ft. wind (70 MPH). The maximum conductor tension will be 29,000 lbs. (60% of ult.). These loads are based on a 50-year return period. Shield wires will be 9/16 inch extra high strength and the same wire will be used as guys. Other portions of the line are to be a tilted bundle of two.

R. S. Wolfe

RSW/hs

cc: Einar Greve
B. M. Zambotti
H. G. Stockwin
J. A. Cain

EXHIBIT 6
DATE ______ DEPOSITION GREVE
Roy M. Profitt - COURT REPORTER

14.4.2

MAIN
CHAS. T. MAIN, INC.
Engineers

OFFICE MEMORANDUM

TO: G. Nesgos
DATE: April 25, 1974

FROM: Einar Greve
FILE: A503-2313

SUBJECT: Report on Radio Interference
Montana Transmission

Referring to our telephone conversation today, we are in receipt of three copies of the report on radio interference. ? As discussed, this report needs to be revised to reflect a right-of-way width of 300 feet as adequate and recommended. It would appear from the report that we then would end up with about 46 dB at the edge of right-of-way, and this is well below the 50 dB level which we indicated earlier would be satisfactory.

? Generally speaking, we have attempted to get not closer than 500 feet to any dwelling. However, we have some exceptions to that between Colstrip and Billings. In two instances it appears that the outside phase runs about 400 feet from the nearest house, and in another instance about 500 feet from a trailer. This is for your information, and need not be mentioned in the RI report.

There are a few typographical errors in the draft report which should be corrected. On page 6, section 5.3, first line, the word should be "counties" and not "countries."

On page 7, the last word in the top paragraph should be "bundles."

In Figure 3, the word "strength" is misspelled.

For brief design reports of this type, you need only send us two clear copies. We can then produce the necessary quantity and bind the reports here.

E. Greve
Einar Greve

EG:df

DATE ____ EXHIBIT 2
____ DEPOSITION GREVE
Roy M. Profitt - COURT REPORTER

MAIN
Engineers

CHAS. T. MAIN, INC.
1800 S. W. FIRST AVENUE, PORTLAND, OREGON 97201 • TELEPHONE 503-222-4227

March 20, 1974

Mr. J. T. Evans
Project Coordinator
Montana Power Company
40 East Broadway
Butte, Montana 59701

Dear Mr. Evans:

Attached is a comparison of costs between the proposed 500 kV AC system and a comparable DC system with additional 230 kV underbuild. The systems are comparable in the sense that they should be able to carry and distribute essentially the same amounts of power. However, the DC system would be inferior from a reliability point of view, since all power is carried on a single tower line. The configuration of the ultimate systems is outlined in the attached sketches.

The estimated cost of AC facilities is our best up-to-date cost estimate with an allowance of five per cent for administrative overhead. The cost for the DC terminals was that introduced by the Department of Natural Resources. The cost of the DC line was also as introduced by the Department, with a very slight increase for the more difficult terrain in Montana.

While the comparison of costs looks convincing enough, it is possible that the DC costs are low, since we believe they are not entirely up-to-date. A more detailed estimate of DC facilities, however, would take considerable time to prepare.

Very truly yours,

CHAS. T. MAIN, INC.

Einar Greve

EG:df

Attachments

(cc- Proj. Pers.)
w/table only

EXHIBIT 8
DATE ______ DEPOSITION ______
Roy M. Profitt - COURT REPORTER
-8808 GREVE

BOSTON, MASS. | CHARLOTTE, NORTH CAROLINA • DENVER, COLORADO • PORTLAND, OREGON

COMPARISON OF COST

Cost Estimate 500 kV AC System	
Colstrip Switchyard	$ 11,350,000
Broadview Substation	15,500,000
Helena Substation	12,000,000
Hot Springs Substation	3,960,000
860 mi. of 500 kV S/C AC Line	108,200,000
TOTAL	$151,010,000

Cost Estimate DC System w/230 kV Additions		
Colstrip:	AC Term.	$ 1,520,000
	DC Term.	56,000,000
Hot Springs:	AC Term.	1,390,000
	DC Term.	56,000,000
430 mi. of DC Line		34,650,000
230 kV Stations:	Alkali	2,170,000
	Billings	170,000
	Anaconda	296,000
445 mi. of 230 kV Line		15,600,000
TOTAL		$167,796,000

EXCERPTS FROM THE DEPOSITION

OF

CHESTER C. TAYLOR

BEFORE THE BOARD OF NATURAL
RESOURCES AND CONSERVATION OF
THE STATE OF MONTANA

IN THE MATTER OF THE APPLICATION OF)
MONTANA POWER COMPANY, PUGET)
SOUND POWER & LIGHT COMPANY, PORTLAND)
GENERAL ELECTRIC COMPANY, THE)
WASHINGTON WATER POWER COMPANY, and)
PACIFIC POWER & LIGHT COMPANY FOR A)
CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED)

DEPOSITION OF CHESTER C. TAYLOR

Taken in behalf of the Department of Natural Resources and Conservation and the Northern Plains Resource Council

BE IT REMEMBERED That, pursuant to stipulation of Counsel for the respective parties, hereinafter set out, the deposition of Chester C. Taylor was taken before Billy P. Ellis, a Notary Public for Oregon, on Friday, the 21st day of March, 1975, in the offices of C. T. Main Company, Harrison Square, Portland, Oregon, beginning at the hour of 1:30 p.m.

APPEARANCES

Mr. John L. Peterson, appearing in behalf of the applicants;

Mr. Arden E. Shenker, appearing in behalf of the Department of Natural Resources and Conservation;

Mr. Leo Graybill, appearing in behalf of the Northern Plains Resources Council.

ALSO PRESENT

Mr. John T. Evans.

CHESTER C. TAYLOR,

called as a witness in behalf of the Department of Natural Resources and Conservation and the Northern Plains Resource Council, having been first duly sworn, was examined and testified as follows:

EXAMINATION

BY MR. SHENKER:

Q How long have you been with the C. T. Main Company?

A Two years.

Q And you first came to Portland in order to work with C. T. Main?

A That's correct.

Q And on the Colstrip project, Mr. Zobel identified this project organization chart for us where it lists the Project Manager as Einar Greve. Is that the position that you now hold?

A Yes, sir.

Q And that was true as of February of 1975?

A Right.

Q Prior to that time you were an Assistant Project Manager or were you a Project Engineer?

A No, I was the Project Engineer.

Q Who has taken your place as Project Engineer?

A No one yet. I'm still functioning in both capacities.

Q Is it true, Mr. Taylor, that you came to the Charles T. Main Company in order to work on this Colstrip project?

A No. I came with the company to work with Charles T. Main.

Q And when they hired you did they tell you this was the big thing they had going that they wanted you to pick up?

A I believe they did mention it-- No. Initially when I first interviewed they did not have this project.

Q When did you first interview?

A I believe it was August of '72-- 1972. Main had set up a joint operation with Steve-Thompson-Runyun here in Portland and they were attempting to fill out their staff, build up their staff so that they could go after work in the electrical field.

Q By February 26, 1975, were you the Project Manager for the Charles T. Main Company on Colstrip?

A Yes.

Q Mr. Taylor, I would like to introduce you to Mr. Leo Graybill, a lawyer for the Northern Plains Resources Council. He sits at my left.

MR. SHENKER: Mark this.

(One-page copy of letter dated February 26, 1975, to Mr. Chet Taylor from John T. Evans, was marked Department Exhibit 2, Taylor Deposition, for identification.)

BY MR. SHENKER: (Continuing)

Q Handing you what has been marked for identification as Department Exhibit No. 2 in connection with this deposition, Mr. Taylor, do you recognize that as a letter of February 26, 1975, received by you from John Evans?

A Yes, sir.

Q Did you have any telephone or other conversation with Mr. Evans regarding the subject of that letter?

A I don't recall anything.

Q Do you recall ever having any conversations with Mr. John Cain, or anyone else from your Montana base of Charles T. Main's operation, in connection with Colstrip regarding Mr. Graybill?

A Just in connection with this letter. When I received the letter I telephoned Mr. Cain and advised him of the contents of the letter, and advised him that-- to adhere to the client's request.

Q Do you know why that request was made of you?

A No.

Q It is a direction to you, is it not?

A It's a direction to me how to relate to Mr. Graybill.

Q When you first became involved with the Colstrip project for C. T. Main Company as a Project Engineer there was, was there not, then in existence the Montana Utility Siting Act of 1973? Do you recall?

A As I recall, it had not yet been completed. It hadn't passed yet.

Q As soon as that bill was enacted you at C. T. Main knew there would be some very great difficulty in meeting the original scheduled Colstrip Units 3 and 4 in 1978 and 1979 respectively, did you not?

A Yes.

Department Exhibit 10 for identification in connection with your deposition today, Mr. Taylor, is a letter dated December 13, 1974, to Mr. Einar Greve from John T. Evans with a copy to you. Do you recall having seen that letter before?

A Yes.

Q That refers to a request that should be met by the C. T. Main Company to submit in writing a detailed statement of the design criteria for 500KV transmission and a detailed copy of methods and calculations employed in generating results contained in the Study of Electrostatic Induction - Colstrip 500KV Transmission as revised on May 30, 1974. Do you know whether that has been submitted to Mr. Evans yet?

A I think A has been supplied; I don't remember whether we have given him B or not yet.

Q Is B still under works?

A No, I think that's been done.

Q That has been completed?

A Yes.

Q It hasn't been sent to him yet?

A It may not have been sent to him. I wouldn't know without going through the files to see.

Q In our review of the documents that we have seen from your files that you have made available to us this week we did not find either Item A or B as referred to in that Exhibit No. 10. Did we just overlook it or is it someplace else in your files?

A Well, I don't recall. There should have been-- I remember writing a letter on Item A because that information was contained in a previous memo that I think Gene Zobel wrote, and so I found that and referred to that in a letter to Mr. Evans. That's my recollection. But Item B, I don't think that has been sent on yet.

Q If it is not too much trouble, Mr. Taylor, sometime after we get out of here this week, if you could check for those two items and furnish those we would appreciate it.

B.

Q On March 10, 1975, Mr. Taylor, you, as the Project Manager, informed all of the people working on the Colstrip project for C. T. Main Company that effective immediately a hold was placed on all system analytical transmission and substation design studies except for those directly associated with the current environmental studies on Units 3 and 4?

A Right.

Q Why did you do that?

were considerable, and we didn't want to have any studies going on that might not be necessary at the present time, or in other words have expenses going on that we could cut off.

Q Rather persuasive what you would have cut out, was it not?

A The bulk of the studies have been completed, and I just wanted to be sure there wasn't somebody back in Boston still playing around with something when it really maybe wouldn't be necessary. We can review it again and determine whether they need to continue.

Q All system analytical transmission and substation design studies, that takes in a rather wide field of activity within C. T. Main, doesn't it?

A Just for this project.

Q For Colstrip Units 3 and 4?

A Yes.

EXCERPTS FROM THE
DEPOSITION OF
ROBERT L. MILLER

BEFORE THE BOARD OF NATURAL
RESOURCES AND CONSERVATION OF
THE STATE OF MONTANA

IN THE MATTER OF THE APPLICATION OF THE MONTANA POWER COMPANY, PUGET SOUND POWER & LIGHT COMPANY, PORTLAND GENERAL ELECTRIC COMPANY, THE WASHINGTON WATER POWER COMPANY and PACIFIC POWER & LIGHT COMPANY FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED

DEPOSITION OF ROBERT L. MILLER

on April 9, 1975

APPEARANCES:

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Billings, Montana
59103

Counsel for The Montana Power Company

DOLORES SALO
Court Reporter
Butte, Montana

BEFORE THE BOARD OF NATURAL
RESOURCES AND CONSERVATION OF
THE STATE OF MONTANA

IN THE MATTER OF THE APPLICATION OF THE MONTANA POWER COMPANY, PUGET SOUND POWER & LIGHT COMPANY, PORTLAND GENERAL ELECTRIC COMPANY, THE WASHINGTON WATER POWER COMPANY and PACIFIC POWER & LIGHT COMPANY FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED)

BE IT REMEMBERED that the deposition of ROBERT L. MILLER was taken by the Department of Natural Resources and Conservation before a Notary Public of the State of Montana on Wednesday, April 9, 1975, at the Courthouse of Silver Bow County, Butte, Montana, commencing at 9:30 o'clock a.m.

ROBERT L. MILLER, being first duly sworn by the undersigned Notary Public to testify to the truth, the whole truth and nothing but the truth testified as follows:

EXAMINATION BY MR. SHERIDAN

to p.2

Q How long have you been employed by the Montana Power Company?

A Thirteen (13) years this year.

Q When did you graduate from college?

A In 1961.

Q Following graduation from college, by whom were you employed?

A Hughes Aircraft Company.

Q How long were you employed by them?

A Eighteen (18) months.

Q From that employment where did you go?

A Montana Power Company.

Q When you first were employed by the Montana Power Company, what was your assignment?

A I was assigned to the Engineering Department.

Q Specifically, what areas of responsibility within the Engineering Department?

A I worked in the sub-station group of the Engineering Department for about four (4) years.

Q What were your major concerns in the sub-station group of the Engineering Department?

A I was in a training program essentially, working toward full fledged engineering status in the company, operating and working on design of sub-stations primarily and related equipment.

Q After being assigned to that training possession, where were you next assigned?

A I shifted to the distribution department of the Engineering Department for a short period.

Q How long were you there?

A Two or three months at the most. I am not sure of the time, but it was short.

Q What were your responsibilities while within the distribution department?

A Basically, I didn't get involved in distribution efforts, I never did shed the duties that I had inherited with the sub-station group and before I got established, the next transfer became apparent so I really didn't inherit any major duties with the distribution section.

Q What was your next assignment then?

A I was transferred to the Operating Department.

Q Where are you assigned now?

A Operating Department.

Q When you were first transferred to the Operating Department, that was when?

A I am not sure of the date but I could check my personal records.

Q Just approximately?

A 1966 or 1967.

Q What were your duties when assigned to the Distribution Department or the Operations Department, pardon me.

A I was Don Gregg's assistant in the Operating Department and training to help him out in that area.

Q What are your assignments now within the Operating Department?

A I am the Manager of Power in the Operating Department. The Manager of the Electrical Operations Department.

Q What do those duties entail?

A Primarily, it is the job of the department, Manager of the department, to manage the total operation of the department and the department is responsible for the entire operation of the electric system, including generation and transfers of power with our neighbors, plus some other functions that aren't related to the main effort.

Q Do your job responsibilities include supervision of planning efforts for transfer of power?

A The only planning efforts we are involved with are the short-term plans as they effect the immediate operation.

Q By short-term, is that day to day operation?

A Generally, shorter than a year.

Q What about your responsibilities with respect to generation of power. Do you have responsibility for planning?

A No, only planning to the extent of short-term operation.

Q And in planning for the extent of short-term operation, what do you mean "planning"?

A We are involved in, for instance, the scheduling of maintenance on generating units on the system, the scheduling of water flow and water releases from the reservoirs on the hydro system.

Q Do you have responsibility for input with respect to recommendations for construction of new power generating facilities?

A I would like you to ask that question again.

Q OK. Are you called upon in your function as the Manager of the Operations Department to make recommendations for the need for power generating facilities?

A Not really.

Q By operation, actual management of the operations of the plant or the planning for and utilization of power generated by the plant?

A Well, the planning function we have relative to the plant are those day by day requirements for electric energy production or maintenance scheduling of the unit.

Q Do you maintain public schedules of the maintenance down time?

A We maintain records. We don't have any formal schedules.

Q What factors do you consider then in determining then when you are going to close a plant for maintenance?

A Uh,

Q I am talking now about a coal-fired plant.

A The primary consideration is our ability to supply the electric energy requirements to our customers and we look at the relationship between the anticipated load during the period of a year and the anticipated resources we have available to us to cover that load, and pick the best time for maintenance of any unit based on how it fits into that plant.

Q In scheduling your down time then for maintenance, you are more concerned with what the demand for load is at the time when your scheduled maintenance is to come about than you are with your regular periodic maintenance schedule, is that correct?

A If I understand what you are saying, my concern is in that area. There are others concerned with when the maintenance is necessary on the unit itself, but that's not my concern.

Q Whose department would that be?

A It is another function of the Electric Operating Department, Ralph Whelchel.

Q Who has the say when you are going to close a plant for maintenance?

A It is worked out on a cooperative basis with the various interests. The manufacturer of the plant in some cases has some say in it. Primarily, it is just between the generation maintenance people and our department.

Q And you are the supervisor and the Manager of those people?

A Yes.

Q Do you have any responsibility for maintenance of reserve capacity?

A Yes.

Q What are your responsibilities in that field?

A In planning, the generation day by day and month by month. We are responsible to maintain certain reserve requirements of operation of our total resource.

Q What are your present reserve requirements?

A We have several reserve agreements, rather complicated in some cases, four or five different reserve agreements that we are contractually bound to, some voluntary agreements.

Q What voluntary agreements are you aware of?

A The primary voluntary one is the Northwest Power Pool Agreement.

Q Under that agreement, what is your reserve requirement?

A I am not certain, I would have to check the record.

Q At the present time your reserve requirements are about 10%, are they not, for your total system?

A Our most stringent reserve requirement calls for 10%, right.

Q And if I am not correct, I think your anticipated reserve requirements by the year 1983 are 20%, is that correct?

A I am not familiar with the long-term reserve requirements.

Q Have you had any input for preparation of the Montana Power Company's long-range plans?

A Would you rephrase that question.

Q Have you had responsibility for any input for the data contained in the Montana Power Company long-range plan dated April 1, 1975? I will show it to you if you want to take a look at it.

A If I had input into this plan, I wasn't aware it was for that purpose.

Q Why in your opinion is there a requirement for a 20% reserve capacity, or if you are not sure of the figure, an increase reserve capacity as the Company has been saying in the years to come as opposed to the 10% you have now?

A The forced outage rate of thermal units is higher statistically than it is on hydro units and as we build more thermal units and larger units, the size of the unit is an important function of the reserve requirement. I would expect, it doesn't surprise me to see that the reserve requirement would be higher and expect it should be from a logical standpoint, because the statistical opportunity for failure of a unit is higher and when you do have a failure it certainly hampers your ability to cover the load.

Q It's true, isn't it, that your reserve requirements can be kept at a lower figure or percentage with thermal units if the thermal units themselves are of lower capacity?

A That is my understanding, yes.

Q So then, with the larger the unit, the greater the requirement for reserve capacity, is that correct?

A I am not an expert in that area, that seems logical.

Q What involvement have you had with planning for or the construction or eventual operational plans for Colstrip Units 3 & 4?

A I had no direct involvement with it.

Q Have you had any involvement with it indirectly?

A We have received requests for information, primarily from the Engineering Department, in many cases. Well, we get routine requests from the Engineering Department. In many cases, we don't know what they are doing with the information.

Q What has been the nature of the request of information submitted to your department?

A Mostly requests of an informal nature, in most cases verbal. In some cases, possibly, informal written requests.

Q For what type information?

A Generally, the only information we have that could be useful in this effort would be historical records based on the actual operation of our electric system, loads and resources.

Q You maintain those records in your department, is that right?

A That's right, the historical records.

Q How far back to they go?

A Some of them go back to the beginning of the company, but they are very sketchy in the old records and, primarily, we attempt to keep the last several years records current and up to date.

Q During the last several years, have there been any changes in the method which you maintain your historical records insofar as what factors are included in the calculation or compilation of those records?

A Yes, sir, many changes.

Q What are some of the more significant changes you have made in the last few years?

A Well, one of the changes, in past years we have had operators, manned positions at several sub-stations, distribution sub-stations. The technology of the industry has developed to the point now that we have no distribution sub-stations with men at those locations. Those men used to maintain, in many cases, hourly records of what was going on at the sub-station. We don't have those records any more.

Q What records then would you maintain in the place of the records that were maintained by the sub-station operators?

A The only records we have at that type of location would be a recording instrument, for instance, on the voltage or flow at the sub-station.

Q What other changes have been made?

A We are undergoing a constant transition in record-keeping and methodology in the dispatch office, and we have changed the output format of the records at that location on a few occasions.

Q Has the change in the output format resulted in a change to existing records in total voltage flows?

A I don't understand that.

Q By making changes in the manner in which you compile data on your electrical power output, have you found it necessary to amend or go back and recalculate historical loads?

A I am still not sure I understand, but we haven't changed any historical records because of the record-keeping format.

Q You have not changed them, is that right?

A If I understand your question, we haven't changed historical records because we have changed format or anything of that type.

Q For any reason, have you changed the total figures reported in your historical records for power consumption and production?

A My only hesitance here is, I am/sure I see what you are driving at, we haven't changed-the records are based on what physically happens. We don't change the records.

not

Q Well, I can see where I might be confusing you. What I want to know is taking the records that you have accumulated on a historical basis, have you because of changes in the manner in which you report consumption and output found that you have higher or lower or the same reported items for consumption output over a period you were not previously reporting?

A Only reason that could exist, that kind of a situation, would be if the question itself changed. In some cases that has happened.

Q In what respect?

A Well, for instance, some of the reporting that we do to the Federal Power Commission, they have changed their reporting forms and in essence, asked a slightly different question than they did on a previous form and the answer may be slightly different. The source data has not changed.

Q You have not been contacted, have you, with respect to giving possible testimony in the Colstrip hearings?

A No.

Q In addition to your duties for generation operation, you also, I think, before the deposition started, told me that you had some responsibility for management of wholesale systems, is that right?

A Yes.

Q What specifically are your duties in that regard?

A As an extension of the responsibilities relative to generation on our system. If we have surplus generation, we plan the transfer of surplus power to our neighbors on a wholesale basis, or if we are short, we will purchase power from our neighbors on a wholesale basis. The management of this type operation comes under our responsibility.

Q You are not responsible for negotiating or finalizing any agreements with respect to transfer wheeling agreements, are you?

A I have been involved in some short-term agreements for extensions of existing contracts only.

Q When in the last year have you been involved with it as far as short term extensions?

A Only one that comes to mind is an agreement with the Bureau of Reclamation which merely is an extension of the sales agreement that we have had with them.

Q Have you had any responsibility for planning or, say, potential sales of power to wholesale customers such as Big Sky?

A No.

Q Morrison-Knudsen Westmoreland Mine?

A No.

Q Any new Air Force base?

A No.

Q Ethel Corporation?

A No.

Q Stauffer?

A No.

Q Conoco?

A No.

[redacted]

Q Have you entered into any exchange, been privy to any exchange agreements with the Bonneville Power Association or administration, calling for the assumption of some BPA loads in return for a release of some of your loads and the assumption of those loads by BPA?

A No. I have heard some discussion in that regard but haven't been involved in it and don't really understand it.

EXCERPTS FROM THE DEPOSITION

OF

FRANK V. WOY

BEFORE THE BOARD OF
NATURAL RESOURCES AND CONSERVATION
STATE OF MONTANA

IN THE MATTER OF THE PUBLIC HEARING ON WAIVERS AND THE APPLICATION FOR CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED FOR THE PROPOSED COLSTRIP PROJECT, UNITS 3 & 4, WHEREIN THE APPLICANTS FOR SAID WAIVERS AND APPLICATION ARE PUGET SOUND POWER & LIGHT COMPANY, PORTLAND GENERAL ELECTRIC COMPANY, WASHINGTON WATER POWER COMPANY, PACIFIC POWER & LIGHT COMPANY, AND THE MONTANA POWER COMPANY

DEPOSITION OF

FRANK V. WOY

taken by and on behalf of the Montana Department of Natural Resources and Conservation, before Ronald J. LaPierre, a Notary Public of the State of Montana, and official Court Reporter of the United States District Court for the District of Montana, Butte Division, in the offices of the Montana Power Building, 40 East Broadway, City of Butte, State of Montana, on the 17th day of April, 1975, at the hour of 11:15 o'clock A.M.

APPEARANCES

For The Montana Power Company:

WILLIAM H. COLDIRON
Executive Vice President
The Montana Power Company
Butte, Montana 59701

For the Montana Department of Natural Resources and Conservation:

TOOZE, KERR, PETERSON, MARSHALL & SHENKER
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For the Northern Cheyenne Tribe:

BURDITT AND CALKINS
By TOM SCHEUNEMAN
Attorneys at Law
135 S. LaSalle Street
Chicago, Illinois 60603

FRANK V. WOY,

called as a witness, having been first duly sworn, was examined and testified as follows:

EXAMINATION

BY MR. SHENKER:

Q Mr. Woy, would you state your full name and present residence for the record please?

A My name is Frank V. Woy, and I live at 107 Rocky Mountain Lane, Butte, Montana.

Q Now, Mr. Woy, I understand that you are presently the Treasurer of the Montana Power Company?

A I am.

Q How long have you served in that capacity?

A Since January 30, 1974, a little over one year.

Q And before that, did you work at the Montana Power Company?

A I did.

Q For how long?

A I began in November of 1971 with Montana Power Company.

Q You have been in the Treasurer's department for some time before January 30, 1974?

A Yes.

Q For how long?

A I have been in the Treasurer's Department ever since October of 1953, in one capacity or another.

Prior to becoming Treasurer, I was the Assistant Treasurer of the Company and Chief Auditor.

Q I take it then, you have training background in the field of accounting?

A Yes, I do.

Q Through college or prep graduate level?

A Business College education.

Q With some Bachelor's degree at the end?

A No, I'm a Certified Public Accountant, State of Montana, however.

Q Okay, in the ----

A And a graduate of LaSalle Extension University.

Q When did you become a CPA?

A I wish I could give you the exact day.

Q Approximate is good enough.

A 1966.

Q Okay. In the course of your work in the Treasurer's Department at the Montana Power Company, you from time to time have had some responsibilities, have you not, in preparing a form 10K to file with the Securities & Exchange Commission?

A I have.

Q And you're familiar with the requirements for the filing of that document?

A Yes I am.

Q And you know, do you not, therefore, Mr. Woy, that it is important that the document be complete and, of course, factual as well as truthful?

A Yes, I do.

Q You know, do you not, from your own perspective on your responsibilities now as Treasurer that your purpose in providing this information to the Securities & Exchange Commission is so that the public, who would have access to the document, would know the financial condition and prospects of this company as it is on the New York Stock Exchange?

A I believe that's a fare statement.

Q Okay. Now, in the process of preparing the most recent form 10K, a copy of which I see you have before you, did you contact members of the engineering department of the Montana Power Company in order to obtain their appraisal of various contingencies and liabilities that the company might have?

A I did not personally do so, but members of my staff did at my direction.

Q Okay. Was it your direction that the information be obtained from the engineering department so that you could place in the form 10K all of the relevant information with respect to the contingencies and liabilities and commitments which the company would have?

A It was.

Q And are you satisfied, Sir, that you received all of that information pursuant to your direction?

A I am.

Q All right sir, to put the same question from the other side of the point, so to speak, Mr. Woy, you would be surprised, would you not, sir, if there were material information that were not in this form if it did in fact describe serious and material impact on the financial condition of the company?

A I would.

Q Not only surprised, you would be distressed, because that would be contrary to the directions that you have given to your staff, isn't that right?

A That is correct.

Q All right. You are familiar with the form 10K that was filed most recently, are you not?

A I am sir.

Q Can you tell me where in the form 10K that information appears?

A Yes, I can. On page 28 of my report to the Securities & Exchange Commission, the last paragraph, and continuing on to the beginning of page 29, we make reference to the possible denial of an application to construct Colstrip 3 & 4 plants, and state in the last sentence: "The company's share of expenditures to date and estimated cancellation costs approximate $5,000,000."

Q Thank you, Mr. Woy. I see that reference on page 29.

A Yes.

Q And I take it that's the only reference to the subject which I asked you about?

A It is the only subject --- it's the only reference to any subject as to what the company's --- the possible impact on the company at the end of the year.

There is one further reference to the Colstrip plants in the narative under Electric Properties, at the beginning of the report.

p. 12

Q

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Q

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Q You have done that in the past, have you not, to make such application and to receive the permission of the Public Service Commission to amortize such charges, in other contacts?

A We have received permission to amortize forward certain charges in the past that's correct.

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Q Mr. Woy, I'm not certain whether I asked you this question already and you made the answer. I thought you did, but my co-counsel tell me that the question was not asked.

It was my understanding, sir, that you had had conversations with the folks here in the Montana Power Company who have told you to the effect that the denial of Colstrip units

3 & 4 would have some serious effects upon the financial condition of the company, is that right.

A My understanding was that the denial of the application to build Colstrip 3 & 4 could have a serious impact on the financial condition of the Montana Power Company. And that was the information that we received pursuant to our inquiries.

Can I elaborate for just one moment.

Q Sure.

A The serious financial impact that we're speaking of, that I'm speaking of ---

Q Yes.

A --- when I am answering the question, is with regard to the amount of money that we have spent to date.

Q I understood that.

A And with the potential cancellation costs that we are advised we may incur. These numbers are not precise. They are merely the best numbers that our engineers and the people closest to the project could come up with, and those are the numbers that I'm responding to and not something further down the road that we have not as yet expended money for or incurred any firm obligation for.

Q That's what I understood you to be saying, Mr. Woy.

A Okay. I just wanted to be certain there is no misunderstanding.

Q When you referred to the "number", that is the figure on page 29 of the form 10K, the $5,000,000 figure, isn't that right?

A That's what I'm responding to, yes sir.

Q Okay, fine.

(Whereupon the witness conferred with Mr. Coldiron.)

Q Okay. Any further clarification expansion?

A No, I don't believe so, Mr. Shenker.

Q Fine.

HEARINGS EXAMINER: Now Mr. Shenker, could you get -- could the Department furnish us with a separate copy of these exhibits so I can put them in as we do our other exhibits?

MR. SHENKER: Shall do.

HEARINGS EXAMINER: Thank you.

MR. SHENKER: At this time, Mr. Davis, I believe we have checked against the exhibit list and I believe I'm satisfied that all of the exhibits that we have offered have been received with those few exceptions that we've particularly discussed. But subject to checking that further just on a clerical basis, the Department of Natural Resources and Conservation will rest its case-in-chief.

HEARINGS EXAMINER: Very well. It now appearing that all parties opponent have rested their cases-in-chief, Mr. Brown representing the Department of Health isn't here, but I have understood that he has no further witnesses and if anyone knows anything to the contrary, there being no evidence of that, well then the case-in-chief will be over and we'll go to the rebuttal testimony by the applicants.

MR. PETERSON: I have at this time one additional statement to serve upon the parties: the testimony of Robert E. Carroll, 2 1/2 pages. I'll serve that at this time.

HEARINGS EXAMINER: Robert Carroll.

MR. PETERSON: We now call as our first rebuttal witness, Bernard Goldhammer.

HEARINGS EXAMINER: Since you've already been sworn, you just can take your old seat I guess.

BERNARD GOLDHAMMER, called as a rebuttal witness by the applicants, having been previously sworn upon his oath, both as to his written and oral testimony, was examined and testified as follows:

(THE WRITTEN REBUTTAL DIRECT TESTIMONY OF MR. BERNARD GOLDHAMMER WAS DIRECTED TO BE INSERTED AT THIS POINT.)

STATEMENT OF TESTIMONY OF

BERNARD GOLDHAMMER

My name is Bernard Goldhammer. I testified previously in this hearing. I am appearing today to discuss three subjects:

1. Load forecasts in the Pacific Northwest
2. National load forecasts
3. The Pacific Northwest-Pacific Southwest Intertie

LOAD FORECASTS - PACIFIC NORTHWEST

Electric energy loads in the Pacific Northwest region are growing and can be expected to continue to grow. Likewise, the loads of the applicants are increasing and can be expected to continue to increase. The Pacific Northwest Utilities Conference Committee on March 1, 1976, published a new forecast for the West Group Area of the Northwest Power Pool. The annual rate of growth anticipated in this forecast over the 10-year period 1976-77 through 1986-87 is approximately 5.1% on peak and 4.8% on energy. Last year's West Group forecast anticipated an annual rate of growth of 5.1% on peak and 4.9% on energy. The loads have not grown as rapidly as anticipated over the past year and as a result, the energy forecast for the year 1976-77 is 465 megawatts lower than was projected last year for 1976-77.

The economic recession has resulted in lower industrial activity, deferring some expansion, and new housing starts being substantially lower than their anticipated levels. I believe that there is a good probability that we will catch up on housing and industrial growth in the area and that our economy will not continue at the present relatively high levels of unemployment. In addition, substitution of electric energy for other forms of energy is likely to accelerate. If this is the case, future electric energy requirements are likely to exceed the PNUCC estimates.

The reduced PNUCC forecast for 1976-77 is based on current loads corrected for temperatures. We have just experienced a fairly warm winter. In January, 1976, the West Group Area average firm energy load was 1,267 megawatts below the forecast. However, January was a very warm month with temperatures throughout the West Group Area averaging more than four degrees above normal. Since loads vary approximately 135 megawatts per degree change in temperature, a departure of four degrees above normal means that loads were about 540 megawatts below normal. Corrected for temperature, the January load would have been 727 megawatts below the forecast. In February, the average firm energy load for the West Group Area was 176 megawatts below the forecast. However, temperatures were 0.6 degrees below normal. Hence, if there had been normal temperatures, the load would have been about 81 megawatts lower. Hence, the February load should be considered as 257 megawatts below the forecast. The increase in loads in February is undoubtedly the result of the rapid pickup in business.

Loads are significantly above a year-ago level. From September, 1975, through February, 1976, average firm energy loads of the West Group Area are running nearly 7% above last year's loads. Last year, loads were depressed because of economic conditions. Even if we take the total loads which include the interruptible loads of Bonneville which are down significantly, the growth is nearly 5% over the September, 1974-February, 1975 period. The Colstrip applicants experienced an increased energy load for the September, 1975-February, 1976 period over the same period of last year of nearly 7%. I have also examined the loads of Puget Sound Power & Light Company for the first 11 days of March. Their energy load for this period averages about 20% over the energy load of last year. However, the first 11 days of March were considerably warmer this year than last year and if I adjust for the temperatures, an increase over last year would still be around 13 or 14%.

There are a number of reasons why loads in our region will continue to grow. Population of the area will continue to grow. Most recent Bonneville estimate is for a growth over the ten years of about 16%. The number of new households will grow even faster than population. The high birthrates in the 1950's and early 1960's will be evidenced by a larger increase in number of households in the late 1970's and early 1980's. The number of households has a greater impact on electrical loads than just population. Another significant factor in the growth of electricity is the rapid price rises that recently occurred in other fuels such as oil, natural gas and coal. The vast majority of new residential units being constructed in this region are installing electric heat simply because it is cheaper than oil. The only thing that could change this situation would be a breakup of the OPEC oil monopoly and a reduction in the price of oil. Another reason that electric loads in the region probably will grow faster than the forecasts is the likely substitution of electric power for other fuels. For example, I am aware of nearly 400 megawatts of proposed conversions from oil and interruptible natural gas to electric boilers to produce steam. These conversions are in the food processing, pulp, and metal industries. Others, that I am not aware of their plans, are undoubtedly considering use of electric energy to replace other energy. The considerations for this substitution are the relative costs and reliability of electricity as compared to the other fuels and the fact that the use of the electric boilers eliminates the problem of air quality control at the industrial facility. Another change would substantially increase loads. The pulp and paper industry is working on plans to convert from chemical pulp to mechanical pulp. The mechanical pulp uses about the same amount of total energy as chemical pulp, but the electrical power requirements are about twice the requirements for the same unit input of wood, requirements of other energy for heat being proportionately reduced. This could result in a large industrial load growth since the pulp and paper industry ranks second to the aluminum industry in electric energy industrial requirements in the region. There is also the potential of new industries in the region. For example, one group has been investigating skimming the ocean for nodules for manganese and other metals. This group is considering sites in the Northwest. They will require 300 megawatts for processing these nodules.

NATIONAL LOAD FORECASTS

National forecasts indicate anticipated average annual national electric power growth will be larger than that forecasted for the Pacific Northwest. Electrical Week of March 8, 1976, lists a number of 10-year forecasts for the nation, as follows: Arthur D. Little, 5.9%; Edison Electric Institute, 6.4%; National Electric Reliability Council, 6.5%; Federal Energy Administration, 5.7%. Also, I have looked at the most recent forecast of the Bureau of Mines of the Department of the Interior. Their forecast for the next 10 years is for about 7% a year. The Bureau of Mines report states, "The electrical sector is the sector with the fastest growing demand for energy."

Nationally, loads are growing with the pickup in business. The Edison Electric Institute's weekly output data for the first eight weeks of 1976 show an increase in electric energy sales of 6.8% over the same 8-week period of a year ago.

The forecasts for the West Group Area are for a lower annual rate of growth than any of the above forecasts for the nation. If we assume that the large electroprocess industries will not grow in the region, then the national and West Group forecasts are comparable. Since the Colstrip applicants do not serve the large electroprocess industry (Bonneville does), we would expect their loads to grow faster than the West Group average. Also, as mentioned above, other industrial load growth may more than compensate for the constant level of the aluminum load.

PACIFIC NORTHWEST-PACIFIC SOUTHWEST INTERTIE

Throughout most of my 31-year career at Bonneville, I did some work on the Pacific Northwest-Pacific Southwest Intertie. In 1944 in a study relative to the possible construction of transmission lines to southern Oregon, I recommended investigation of the interconnection of the two regions as part of planning service to the southern Oregon area. Others also proposed such an interconnection. Investigations started after World War II, but it was not until 1964 that the Intertie was approved by the President and Congress. The approved Intertie consists of two 500-kV AC lines from John Day Dam to the Los Angeles area; and two 750-kV DC lines, one from The Dalles to the Los Angeles area and one from The Dalles to Hoover Dam with a 345-kV AC line from Hoover Dam to Phoenix, Arizona. The first AC line was completed in 1968; the second was completed in 1969; and the DC line to Los Angeles, in 1970. The southern part of the direct-current line to Hoover Dam was started by the Bureau of Reclamation, but Bonneville was unable to secure the necessary appropriations and, consequently, in 1969 the construction of the line was postponed indefinitely.

The lines constructed have proved to be extremely valuable for both regions. The types of transactions over the lines are as follows:

1. The sale of surplus energy from the Pacific Northwest to the Pacific Southwest. This is energy that cannot be used in the Pacific Northwest and cannot be conserved for future use in the region.

2. An exchange of peaking capacity for off-peak energy. Bonneville supplies the California utilities with energy during the daytime hours. This energy is returned during nighttime hours, plus additional energy for payment since the daytime energy is more valuable than the nighttime energy.

3. The Central Valley project for a 10-year period January 1, 1972, through December 31, 1981, will receive 400

megawatts at the California-Oregon border from the Centralia coal-fired plant. Through this sale, the two units at Centralia were built one after the other, and consequently at a much lower cost than if one unit had been built later. Also, the construction was a couple of years earlier than needed by the participants in our region.

4. The Intertie was an important factor in implementing the Treaty with Canada. The California utilities agreed to buy most of the Columbia Storage Power Exchange (CSPE) power. The CSPE power is Canada's share of the Treaty power purchased by Pacific Northwest utilities. This power has been withdrawn with the exception of the sales to the state of California for pumping purposes -- 150 megawatts through March 31, 1978, and another 150 megawatts through March 31, 1983.

5. California utilities have purchased other power from Pacific Northwest utilities and industries, such as Hanford energy, energy from additional storage in Canada, energy from steam plants that is not needed at the time in the Pacific Northwest.

6. Sale of excess energy, that is, energy which the California utilities can generate in excess of their own requirements, which may be needed in the Pacific Northwest.

From the time the first line went into operation in 1968 through December 31, 1975, there has been a total of approximately 90 billion kilowatt hours delivered to the Pacific Southwest from the Pacific Northwest, and nearly 6 billion kilowatt hours delivered from the Pacific Southwest to the Pacific Northwest.

The largest item delivered south has been surplus energy which otherwise would have been wasted. Power from the south to the Pacific Northwest was principally exchange energy and excess energy that northwest industries and utilities purchased during periods of adverse water conditions. This past year, about 9 billion kilowatt hours of surplus energy were sold in California. We have experienced one of the wettest seasons we have ever had. This is in sharp contrast with 1973 when virtually no surplus energy was sold in California in that it was a critical water year in the Pacific Northwest.

In 1975 investigations again started on the second DC line to the Southwest. It is now considered feasible that this line be built from The Dalles to Phoenix. The original intent of this line was an exchange as a result of the diversity in the two areas. The Pacific Northwest has a winter peak due principally to electric heat. The Pacific Southwest has a summer peak due principally to air conditioning and to irrigation. Power from the Pacific Northwest can be sent south in summer and returned in winter. It is estimated that the earliest the line could be in operation would be January, 1984. The line would be 1,054 miles long and currently is estimated to cost about $558 million.

Neither this line nor the existing Intertie lines will substitute for Colstrip 3 and 4, which are expected to be in operation in 1980 and 1981. The firm power (Centralia and CSPE) sent south is included in applicant' loads and loads of other utilities when such power is withdrawable. The proposed line to Phoenix will increase the firm peaking capacity but is not a substitute for the firm energy needs of the applicants.

MR. PETERSON: There's one correction to make on the statement, Mr. Davis. On page 5 at line 17, the word "incomparable" should read "comparable."

HEARINGS EXAMINER: Very well. Mr. Shenker, cross-examination?

MR. SHENKER: Thank you, Mr. Davis. The record should show that on Friday of last week I advised Mr. Bellingham that we had no cross-examination to make of Mr. Goldhammer. Unfortunately, this morning when I boarded my plane in Portland, he was boarding the same plane. I told him that I had so advised Mr. Bellingham and, unfortunately, evidently the message didn't get to him. So, as long as Mr. Goldhammer is here, as the record will recall, he and I and our families are old friends, we might as well have a few questions to ask of him.

HEARINGS EXAMINER: Well, actually, do you have any other witnesses to call this afternoon, Mr. Peterson?

MR. PETERSON: We hadn't planned on any.

HEARINGS EXAMINER: Well, let's just go ahead and have a visit, then.

EXAMINATION OF BERNARD GOLDHAMMER

Rebuttal, Cross, by Department of Natural Resources and Conservation, By Mr. Shenker:

Q The fact of the matter is that I asked you on our airplane on the way out here, Bernie, didn't I, if there was something that I should ask you about, and you did have one suggestion?

A Right.

Q You've noted that in some of the testimony from time to time, that has been furnished to you for your review by the applicants, that folks refer to the Pacific Northwest power pool, they refer to the West Group, and they refer to the Western States System Coordinating Council.

A Right.

Q Those, of course, are not interchangeable references, are they?

A Right. No, they are not.

Q For the record, in one place now, would you define what those three separate references should be?

A Let me start out with the West Group area and define it first. I'm going to define it largely on the service area of the utilities, because otherwise I think we get into confusions on it. The West Group area includes the service area of Bonneville for firm power, and that includes Bonneville service in the state of Oregon, state of Washington, Idaho, western Montana, a little bit of Wyoming, a little piece of Nevada, and a little bit of northern California where some cooperative serves. Otherwise, the service area is confined to those states. It also includes the service area of four of the applicants here at Colstrip. That is, the service area of Portland General Electric, the service area of Puget Sound Power and Light. For Pacific Power and Light, it includes its service area in Oregon, Washington, Montana, and northern California. For Washington Water Power, it includes their entire service area. So if we take these service areas, we include the West Group area, and we look at it on a map, it would include all of the state of Washington; it would include most of Oregon - the eastern part of Oregon served by Idaho Power Company and California Pacific Utilities would not be included; it would include northern Idaho and the part of southern Idaho served by Bonneville; and it would include little pieces of Wyoming, and Nevada, and northern California; and it would include western Montana except for the area served by Montana Power Company - that is excluded from the West Group. Now, if we take the next one that's referred to in the exhibits and in the testimony, we come to the Coordinated System. The Coordinated System includes everything I mentioned in the West Group. In addition, it includes the Montana loads in western Montana, Montana being Montana Power Company, being a signator to the coordination contract, and it refers to those in the coordination contract. All right, the next group we come to is the Northwest Power Pool. It includes everything I mentioned before, including all of Montana Power Company's service load, the service of Idaho Power Company, Utah Power and Light, and of B.C. Hydro and West Kootenai Power and Light in Canada. Then we get to the Western Systems Coordinating Council group. That includes all of the Pacific Northwest. It includes the Pacific Southwest as well, California, Arizona, Nevada; it includes Colorado, New Mexico, and includes the western part of the United States.

Q Good. Thank you. I'll try to find a few other questions for you. One that occurs to me is that in your statement you do observe, of course, that the new West Group Forecast out just recently, of course, decreases the load projected for the West Group members.

A That's right.

Q You had a discussion about that with Dr. William Brewer about a week or two ago, did you not?

A Right.

Q At which time you told him that would be the case, that the West Group Forecast would show a flattened load, in effect backing up the load one year?

A Approximately. It's not quite a year, but it's close to it.

Q You also discussed in your statement some national load forecasts and projections. Are you familiar, Bernie, with the bulletin that came out, I think announced first in Electrical World in February of this year, on the position paper taken by the Federal Power Commission with respect to use of natural gas for home heating?

A I'm not familiar with the details of it, just in very general.

Q Well, in general of course, the FPC said that utilities should encourage increased usage of natural gas for home heating, at the same time they should flatten their electricity demand projections?

A Right.

Q Right?

A Right. I would say, though, in the Northwest you have a different problem with the natural gas because of the problem of getting it from Canada.

Q The last time you testified you had not yet taken a deep look into such questions as price elasticity and cross elasticity. Is that still the case?

A That's still correct. That's right.

Q And another thing that you might help us with, perhaps, for the clarity of the record, if you'd look on page 7 of your statement, you refer on lines 23 through 28 to the delivery of kilowatt hours to the Pacific Southwest from the Pacific Northwest --

A Right.

Q -- and from the Pacific Southwest to the Pacific Northwest.

A Right.

Q The terms that we're most familiar with in this proceeding for measuring units are in megawatts. Would we find kilowatt hours by dividing by 8,760 for one year?

A You mean finding average kilowatts?

Q Yes.

A Yes, it would. It'd be 8,760 gives you the average kilowatts. Average kilowatts in this sense, I might say, I use kilowatt hours because average kilowatts or average megawatts, it doesn't have much meaning in these cases, because you have power available, for example, during nighttime hours sometimes during a surplus; you don't have any during the daytime hours.

Q Right. If the utility were trying to measure in terms of what its average energy sold was in a particular year, in megawatts, that's how they'd do the mathematical conversion, right?

A That's right.

energy to serve the loads in the area?

A You have enough firm power to carry the firm loads, and then you take, on top of it, the interruptable loads. The probabilities of just carrying them throughout the year is only about 1 in 10, but Bonneville uses advance energy, which we call, which draws down the reservoirs in advance. That increases the probability of something between 40 and 50% of the time that that can be carried, based on, again, the 40 years of historical record.

Q What, in your opinion, is the probability of having the industrial interruptable loads served, and at the same time, have approximately 1,000 average megawatts for surplus for a year?

A That probability is extremely small that you have the industrial -- even a year like this, for example, which is a very wet year, no surpluses were available in August or the first part of September, so it's a very minor probability that you'd have that amount of power.

Q Has there been any recent movement in BPA relative to their load forecasts and how they're going to treat their preferred customers?

A Well, just this past week, within the last 10 days anyway, the Bonneville administrator sent a letter to the chairman of the Public Power Council which summarizes some discussions he had with the Public Power Council, and these discussions range 1) that Bonneville will give notices of insufficiency to the public systems, which means that beginning July 1st, 1983, the public systems will no longer be able to look to

Bonneville to meet their load growth - they'll have to supply it from other sources; and secondly, it summarizes the discussions in which the public systems will make application for the power that Bonneville now serves to the large industrial customers when those contracts expire.

Q What, then, would happen to the service of the large industrial customers by BPA?

A At this juncture we don't know what'll happen because, even though we have started making some investigations of it, there's a number of alternatives that could happen. We think that the industries could still secure the interruptable power and the reserves that they serve to Bonneville. This would leave about half their load of about 2,000 average megawatts to be secured from other sources. We have made -- in some cases the industries have made investigations of the local utility as to whether or not, when those contracts expire, they would be willing to serve it. For example, Stauffer Chemical has contacted Montana Power Company relative to service. There's been some discussion of Puget Sound Power and Light serving Intelco. But what way it'll go, we just don't know at this junction.

MR. PETERSON: I have nothing further.

Rebuttal, Re-cross,

By Department of Natural Resources and Conservation,

By Mr. Shenker:

Q Well, I think just one question, Mr. Goldhammer. The points that Mr. Peterson just asked you about on redirect, you referred to in some length in your original testimony. You don't have any changes from your original testimony as to the alternatives, which ways you go?

A On the service industries, we just don't know at this juncture. We're studying it. We had hoped that the industries would have gone along on a declining basis of withdrawal such as we have proposed in Phase 2, but at this juncture we just don't know what will happen.

Q As far as the bulletins or publications or announcements from Bonneville are concerned, those really don't constitute news? That's development that's been going on over some period of time?

A Well, except for one factor here. If Bonneville had been assured that the WPPSS 4 and 5 plants would be on schedule, there wouldn't have been any need for a notice of insufficiency, because the public systems would have been taken into their own system sufficient loads. This came about because we don't know whether number 4 and 5 can be constructed on the schedules originally proposed, which would leave a gap, and Bonneville, in giving notice of insufficiency is protecting itself of not having to go out and search the woods for power or breaching contracts.

Q Those are nuclear facilities that the public systems are going to own something of?

A They own, in the case of number 4 and number 5, they own the bulk of it. 4 they own 100%, and 5 they probably own 90%.

Q And they're backing off with some of those?

A They're not backing off of them. It's just a question as to whether they can proceed and build them on the schedules they had originally intended. They're still going ahead with them. One of the resolutions that's mentioned here in the letter from Bonneville is that the public systems have agreed to proceed with, as rapidly as they can, with 4 and 5, but we don't know whether that meets the time limit of getting the power as needed.

Q We know that rapidly means slower than was first thought?

A Right.

MR. SHENKER: Nothing further. Thank you.

MR. PETERSON: That's all I have. Thank you.

HEARINGS EXAMINER: Thank you, sir. We will be in recess until 9:00 in the morning.

(RECESSED AT 3:45 P.M.)